THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1588.] LONDON, OCTOBER 17, 1893. [45TH YEAR. PRICE 6d.

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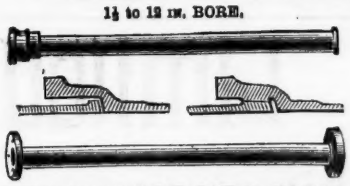

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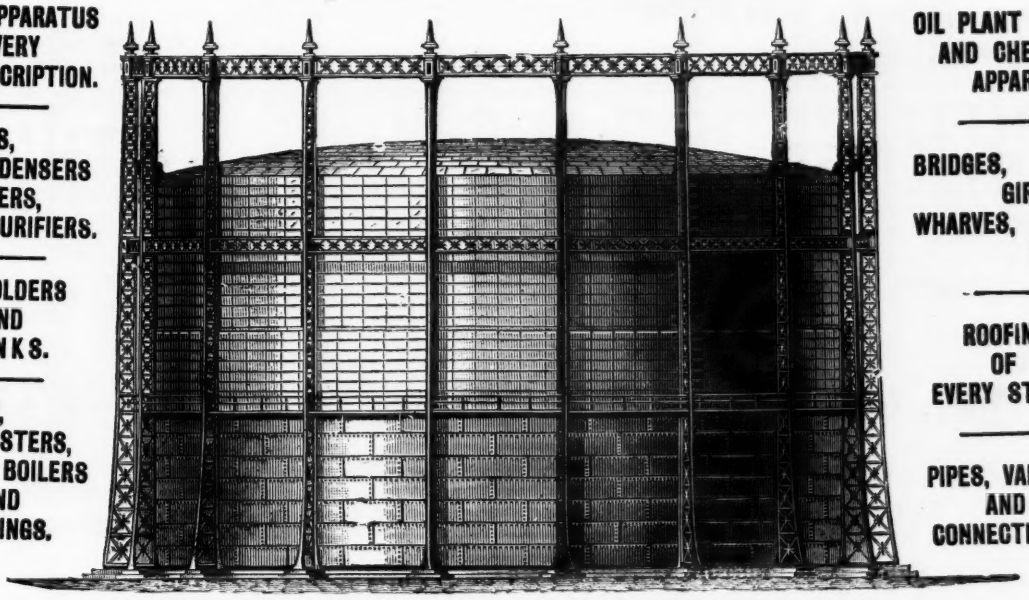

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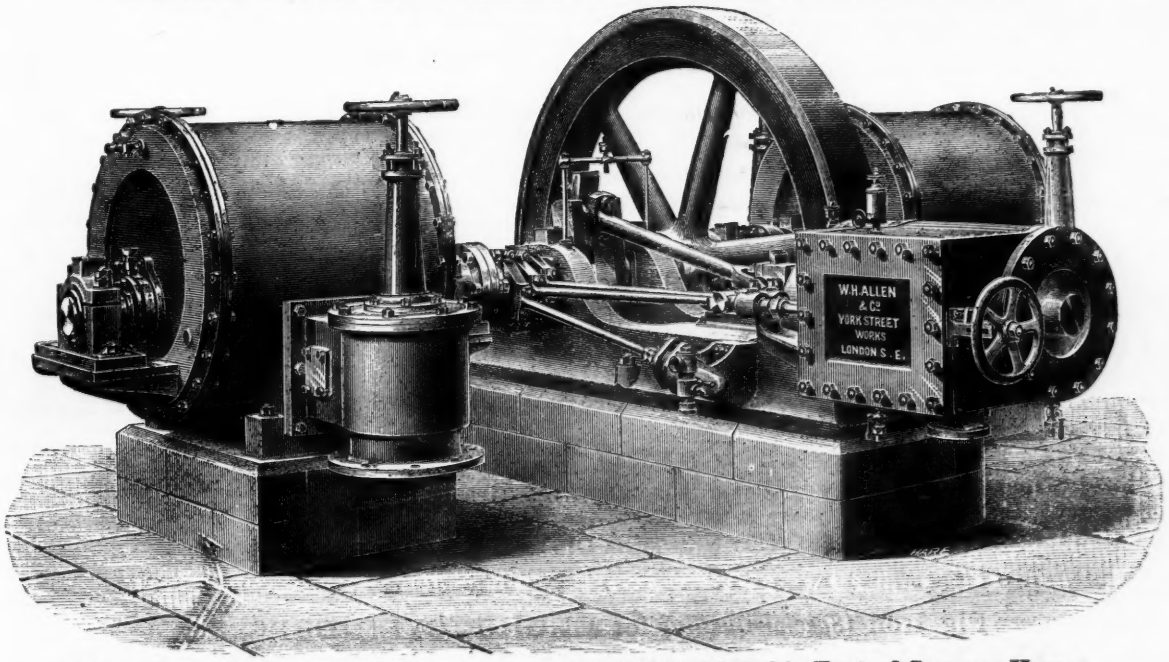

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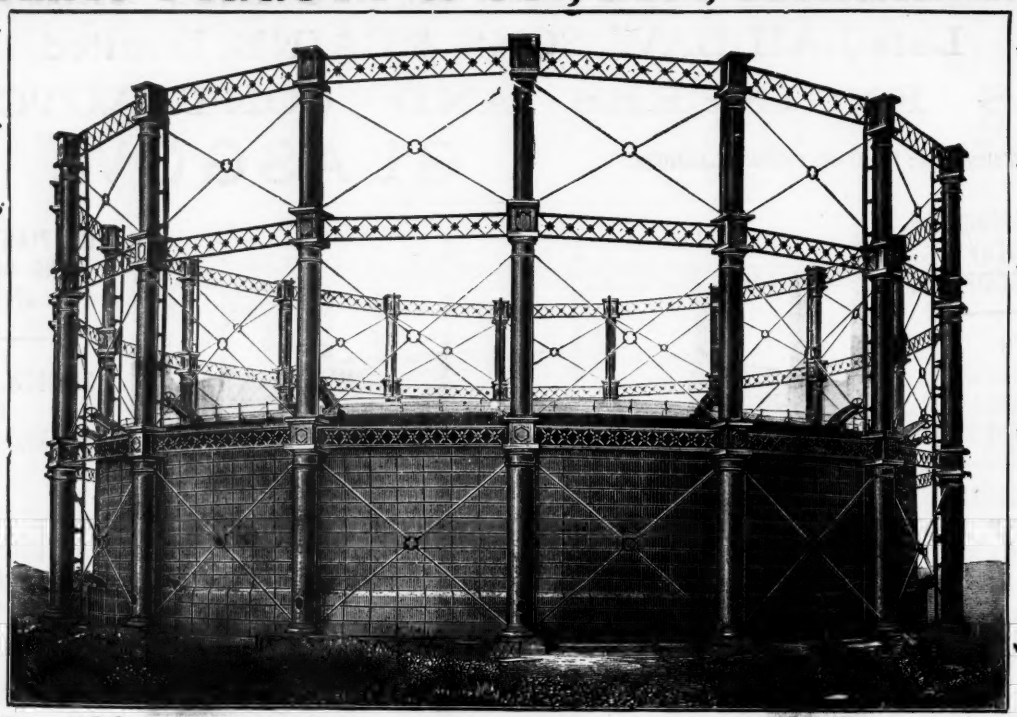

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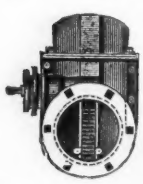

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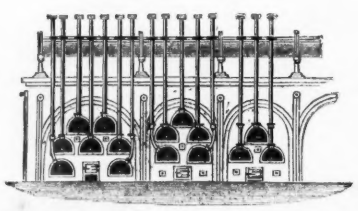

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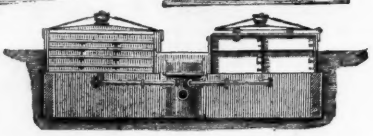

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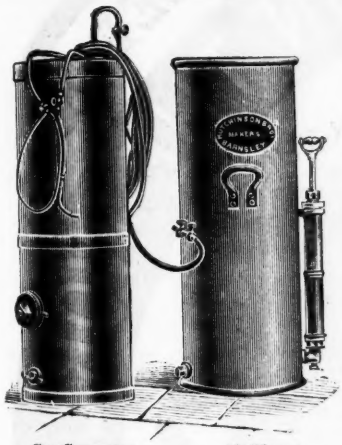
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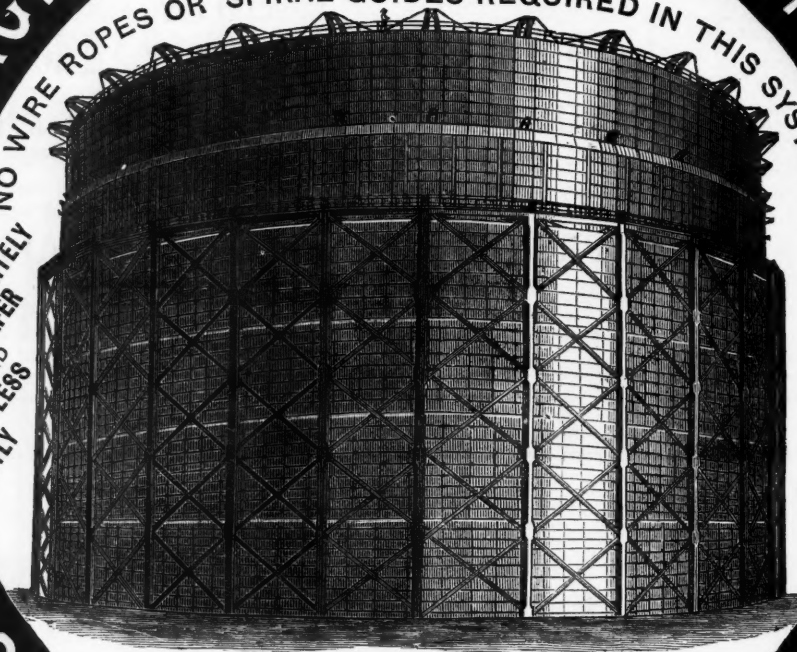

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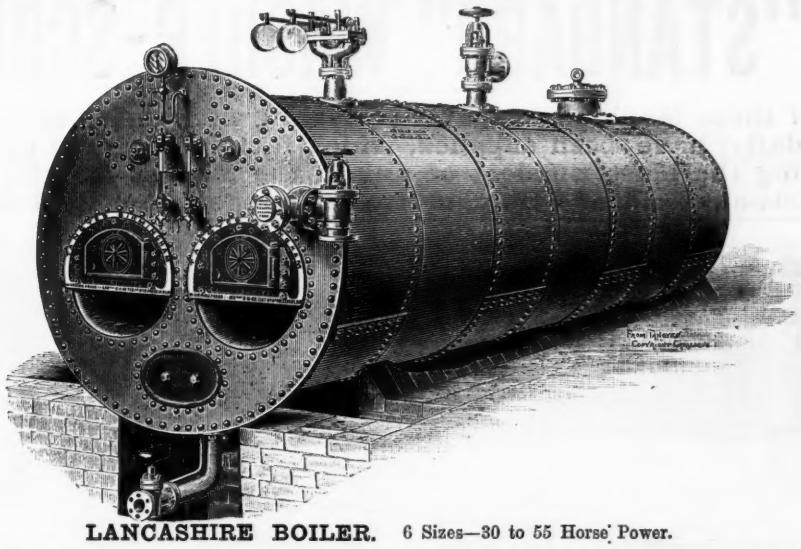

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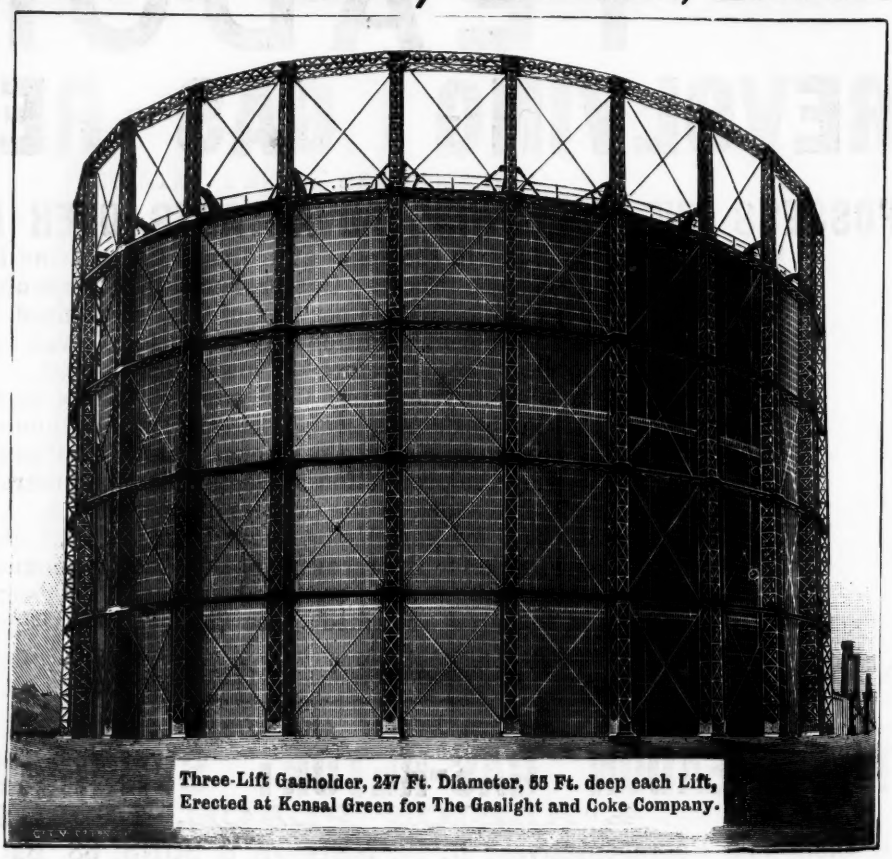

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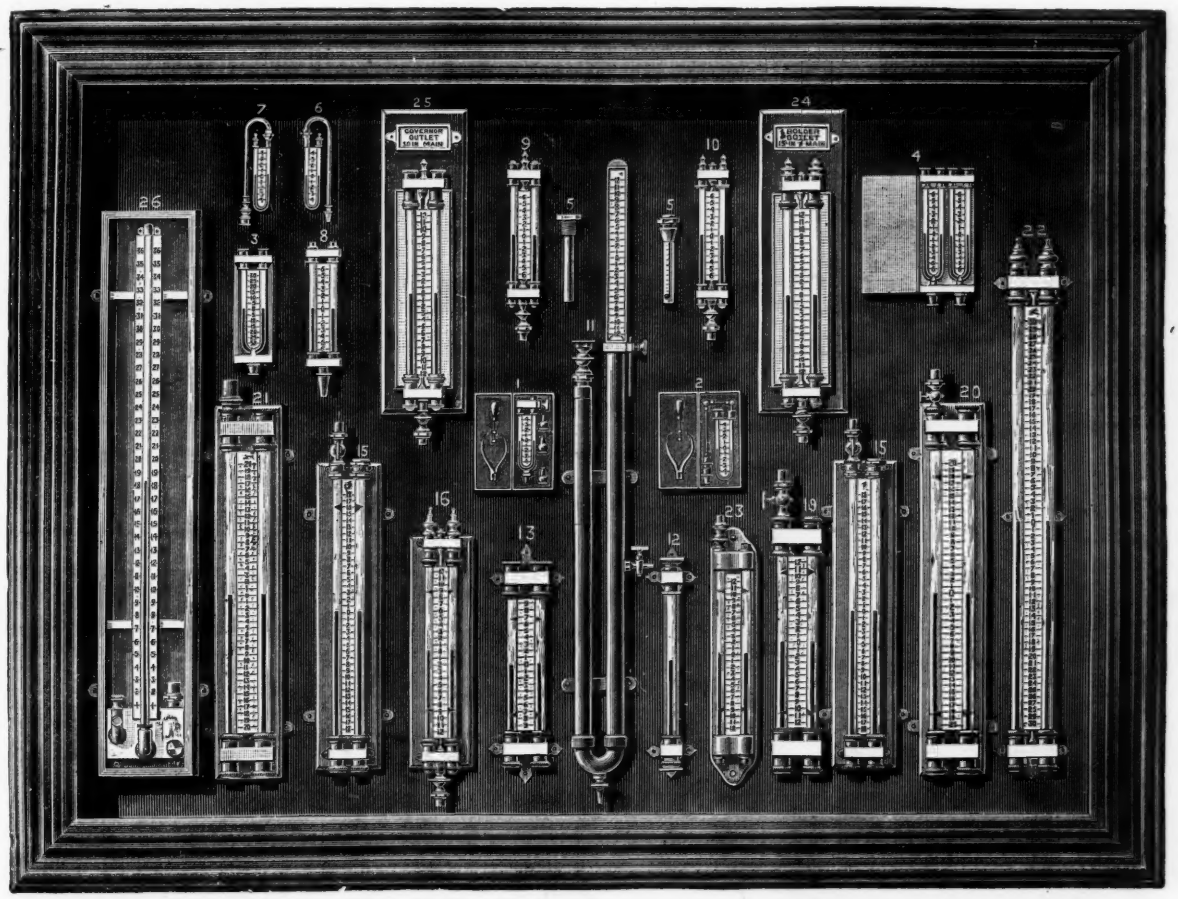

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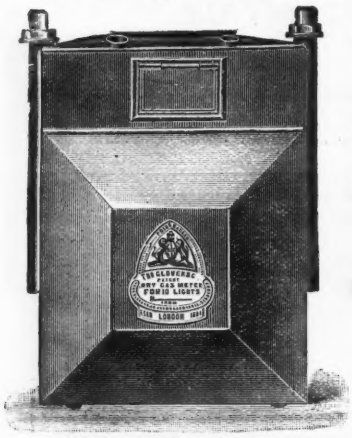

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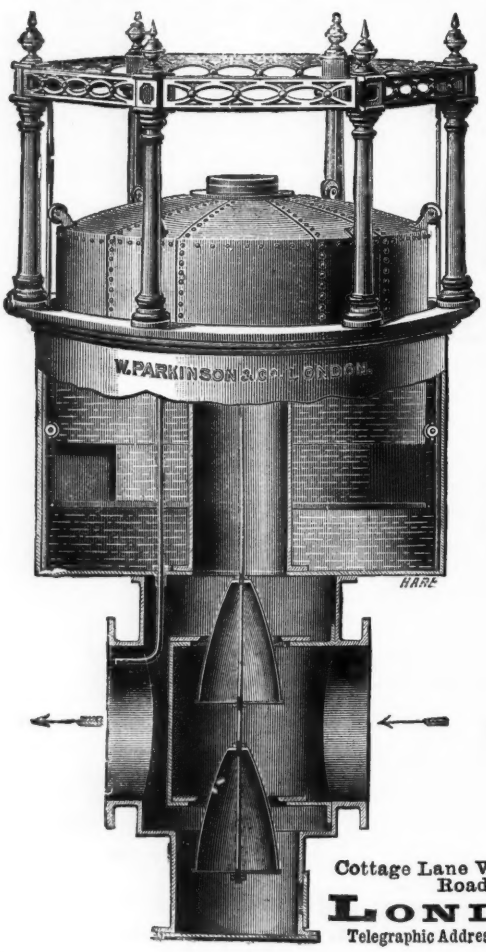

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 17, 1893.

The Proper Way to Regulate Coal Prices.

NOTHING further of any importance has transpired respecting the prospects of the projected Coal Trust; but the public will be curious to learn how Sir George Elliot and his associates fare in their attempt to consolidate the interests of the three parties to the trade—the colliery proprietors, the miners, and last, but not least, the consumers. Mr. George Livesey has indicated the chief objection to the scheme as propounded; and this is precisely the point in regard to which the plan differs from the sliding scale as applied to Gas Companies. Sir George Elliot has appealed to the example of the sliding scale in the gas industry as constituting ample justification for his own proceedings; but the parallel sought to be established between the two systems of regulation is not exact. He appears to have overlooked the essential principle of the gas supply sliding scale, which consists in making it advantageous to the manufacturers of gas to sell it as cheaply as possible, by permitting them to increase their dividends whenever they have been in a position to reduce their selling price below the standard at which their undertaking may be deemed to be able to do a fairly profitable trade. If something similar could be applied to the coal-mining industry, the chief objection to a Trust would disappear. The cardinal principle of a producers' Trust, or Syndicate, after the American model, is the maintenance of selling prices at a paying standard. There is no inducement to lower this except outside competition, which it is the aim of those who constitute the Trust to prevent. The great recommendation of the gas sliding scale is that it preserves, and even accentuates in the case of the business so protected, the same inducement to cheapen production that operates by the agency of competition in a perfectly open market. It is a concrete expression, so to speak, of a law of industrial economy that is only understood by traders of the clearest and most advanced views. The short-sighted merchant sees no farther than the infantile maxim which makes successful trading consist in "buying cheap and selling dear." It is a great step from this perception to the converse proposition, that the most profitable trading is that which sells as cheaply as possible.

In the infancy of commerce, it was the custom for people who had things to sell to put the price up to the extreme limit which other people could be persuaded to pay for them. The natural consequence of this practice was that nobody bought anything more than was absolutely needed, and that trade was limited to the smallest possible demand and supply. When it dawned upon merchants that the better way was to put things upon the market at the lowest practicable price, irrespective of what purchasers might be supposed to be willing to pay for them, and so to create an enlarged demand, the horizon of trade was widened immeasurably. This is what the sliding scale does for the gas industry; and it is to be regretted that the truth of the principle is so little understood even in some gas undertakings now working under this enlightened regulation. Outside sliding-scale Companies, it is hardly understood at all. One still hears members of Local Authorities having the control of gas supply assert that gas at such and such a price is "cheap enough." The men who talk like this are still in the dark ages, and they certainly cannot logically attack Sir George Elliot for proposing as a fixed price for coal some figure which he is also persuaded is "cheap enough." The point is that a commodity is never cheap enough so long as it is possible to produce it still more cheaply. A retail grocer could with equal force assert that tea at 2s. 6d. a pound is cheap enough; and he might, perhaps, support the declaration by demonstrating that he can with difficulty make the trade pay at the price. Then comes along another dealer who offers tea at 2s. a pound, and makes a fortune out of it. It is the volume of commerce, rather than the high profits of a select trade, that pays in the long run. This principle is nowhere more pointedly expressed than in the sliding scale of British gas undertakings; and it is upon the selfsame principle, and on no other, that a universally acceptable combination of interests in such an industry as that of coal production must be based. It has been objected that those who are willing to see the coal trade syndicated, provided this can be done in a proper manner, ought to take the further step of agreeing to the nationalization of the whole coal industry. This does not follow, however, because, apart altogether from the comparative inefficiency of Government control of an industry, as contrasted with the operation of private interest, as soon as Government took hold of the coal trade, the assumed interest of the taxpayers would come to the front, as that of the ratepayers does when gas supply is municipalized; and the old fallacy of "cheap enough" would check further reductions of price below an arbitrarily assumed standard.

A "New and Novel" Gas Process at Chicago.

For an example of the manner in which the business of gas supply is worked in the United States, one could hardly do better than trace the history of the gas undertakings of Chicago. It would be impossible to do this in a single article in the Journal, to say nothing of a single paragraph in the editorial columns. Indeed, it may well be doubted if any living man could say off-hand how many "combines," "raids," and "deals" have gone to make the Chicago gas business what it is; and nobody knows what the prevailing American custom in this regard has cost the Chicago people. The story is not finished, moreover; for yet another speculation of the usual kind is afoot. It is the necessary consequence of American gas-works "deals" to reproduce their species; and the more Gas Companies there are in a particular district, the more applications there are for "franchises." So in Chicago, as if there were not already more than enough of these Companies, seldom does a year pass without another one being foisted upon the district. The latest is described in Chicago newspapers that have just come to hand as a venture of the Rew interest. Mr. H. C. Rew is a veteran "gas man," who in his mature age has produced a process which claims, of course, to be the "biggest thing on earth." It is a sort of hybrid between the retort and cupola systems, and employs bituminous coal and the crudest of crude oil; and if the results it gives are only about half as good as the glowing fancy of the inventor pictures them, it is only a question of time for Mr. Rew to possess the earth—in the way of gas engineering. Armed with his wonderful process, Mr. Rew and his friends have boldly attacked the Chicago Board of Aldermen with an offer to sell 24-candle gas for 80 c. per 1000 cubic feet—the standard price in the city, as settled by the "Trust" which represents the existing gas interests, being $1·20. Moreover, they promise to have plant capable of producing 10 million cubic feet of gas (per day) ready in 30 days, to pay the city $10,000,000 for their franchise, to make the existing Mayor of Chicago President of the Board, and to allow one or more Directors of the undertaking to be nominated by the City. The Company will bind themselves never to charge more than the stated price for their gas; and they promise to reduce the rate until a "fuel basis" is reached whereby the gas will be cheaper than coal, and the smoke nuisance, which is a reproach of the city, will disappear. A local newspaper (of course perfectly disinterested) thinks the above "a fair "proposition, that should meet the approval of every "alderman." We venture to submit, with all deference, that the terms offered are not good enough. Seeing that, according to the same weighty authority, the Rew method of gas making "provides for the complete combustion of "the primary products within the apparatus while heating "up, and perfect chemical changes while making gas, "thereby requiring less fuel and not only greatly cheapen-"ing the cost of gas but also greatly improving it in "quality," bearing in mind also that the Rew gas is credited with other advantages both "entirely novel and "new," and as being a "most decided and radical improve-"ment over every other process and apparatus in the "market," the least its proprietors could do, in order to secure the favour of the Chicago people, would be to wipe out the loss upon their Exhibition.

A Gas-Meter Libel.

Probably there has never been such a time of feverish energy in the cheap periodical trade as now. Throughout the United Kingdom, the principal newspapers hold their own; and well-established and intelligently conducted magazines, specialist journals, and reviews keep their regular readers. But besides these there is a wonderful growth of catchpenny publications that appear chiefly weekly, and respecting most of which it may truly be said that they serve no useful purpose, and are not missed when they die, which happens very frequently. Few of these mushroom periodicals are bought to read. They are insurance policies, "lucky bags," or what not. Some of them, however, do aim at being purchased for their matter; and with the conductors of these the composition of the "contents bill," which is to catch the eye, whet the curiosity, and conjure the penny out of the pocket of the casual loiterer by bookstalls, is a serious care. A week or two ago, one of the most respectable of the weekly pennyworths came out with a flaring proclamation that it contained the sure way of preventing "gas-meter frauds." How many gas consumers who would not otherwise have spent a penny upon this production of the teeming nineteenth century press—the glory of the age—were caught by this lure, cannot be guessed; but those who bought the paper with the expectation of finding in it some damning revelation of the iniquities of gas-meters must have been wofully disappointed, for there was nothing more in its pages relating to the subject than a particularly tame description of the gas-meter index and the way in which it is read. We protest, however, against the gratuitous conjunction of the words "meter" and "fraud" in a paper, without any endeavour being made to show that the connection is warranted. The "harmless, necessary" gas-meter is considered fair game for the newspaper witling; but if these instruments were guilty of misrepresentation in the manner of the drafters of the contents bills of catchpenny journals, they would soon be hurried to the scrap-heap.

The Coal War—Nearing the End.

The meeting of the two parties to the coal war, with the six Mayors, as discussed in last week's issue, was duly held at Sheffield; and the outcome will be found recorded elsewhere. It is satisfactory to know that the absurdity of a revision of contract prices to meet the demands of the men, so eagerly approved of in advance by the stern economists of the *Daily News*, did not find a place in the programme of the civic authorities who played the part of *amici curiæ* on this occasion. The behaviour of the Mayors was beyond all praise for prudence. Having brought the coalowners and the men together under one roof, they stood aside, and let these two parties talk over their differences in private, until they admitted that there was no chance of their coming to an agreement. Then they made their suggestion, which was practically to the effect that the men should go back to work at the old rate of wages for six weeks, when a reduction of 10 per cent. on the 40 per cent. advance since 1887 should be made, and the future regulation of wages by selling prices should be settled. The proposal was, as a matter of course, immediately rejected by both parties; and it has been equally, also as a matter of course, acted upon since in different parts of the country, where mines have been re-opened at the old rates of wages with more or less reference to the possibility of the question being raised again at Christmas or thereabouts. The effect of even this partial resumption of work at the pits has been most marked; retail prices of coal having fallen everywhere "by lumps," as the disgusted merchants would say. For a serious disturbance of the coal trade, such as has been in evidence throughout the Midlands and the southern parts of the kingdom during the last two months, does not really benefit in the long run even those middlemen who appear to profit most by the advanced prices. If they happen to have at the commencement a large stock, bought at a normal cost, which they are afterwards enabled to dispose of at famine prices, they are compelled to go on buying at advanced rates in order to keep a supply for their customers; and at the last, when the collapse comes, they are quite likely to be caught with a quantity of coal that has cost them dear, and can only be disposed of at a loss. The *Daily Chronicle* and some other popular prints have cherished the notion that the lock-out has been the work of the wicked coalowners, who, it is alleged, united to demand an utterly impossible reduction of wages with the deliberate intention of forcing their men to suspend production, in order that they might dispose of their encumbering stocks at a great advantage. This end having been attained, it is imagined that there will now be no obstacle to the general resumption of work on the old terms—this being all for which the men have been standing out. If the masters had any such nefarious object in view, their turpitude in forcing the lock-out could hardly be denounced in too strong language. Happily for their credit for the possession of common humanity, to say nothing of common sense, the figures contributed on the masters' behalf to the statement of the case for a reduction of wages stand for reference, and have never been attacked by those who refuse to accept the conclusion at which they point. Moreover, it was only after the contract prices for coals had been settled for the year that the employers formulated their *ultimatum*. Nothing that has since occurred can alter these conditions of the trade,

While the lock-out and strike have endured, the coal-ownershave been absolved from filling their contracts, and have sold at a profit their stocks and the sweepings of their pitches. With the resumption of work, however, the terms of overdue contracts resume sway; and it is these that must control the issue in the long run. The country is heartily sick and weary of the whole affair; and nobody will be too curious to inquire precisely how much each side has gained by fighting, so long as work is resumed as generally and as speedily as possible.

Courts of Arbitration and Law Courts.

An interesting paper on "Chambers of Arbitration" was read at the recent meeting in Manchester of the Incorporated Law Society, by Mr. Herbert Bentwitch, one of the Legal Arbitrators appointed by the London Chamber of Arbitration. We noticed and commented upon this experiment in the direction of procuring the cheap and expeditious settlement of commercial disputes at the time of its inauguration; and we have waited with some little curiosity to learn how the plan works in practice. There have been disquieting rumours pointing to something very like failure of the system, owing to the slowness of parties to take advantage of the new substitute for litigation; and it is interesting to hear what people intimately connected with the Chamber have to say about its proceedings. Mr. Bentwitch, speaking as a member of the legal profession, endorses the observations of Professor Nicholson at the British Association meeting, and admits that "our Courts "of Law, as at present constituted, do not afford to the "suitor the redress to which he is entitled, with the same "expedition which he is entitled to expect." Mr. Bentwitch goes on to argue that it is the duty of lawyers to follow the wishes of men of business in the matter of seeking means for the speedy and expeditious settlement of their disputes, with the object of rendering more certain the administration of justice by the improvised tribunals to which the commercial community shows a growing tendency to repair, and which might easily go wrong without the guidance of trained and experienced practitioners. He proceeds further to claim that such tribunals, with daily sittings, with no long vacation, with right of audience at every stage of the proceedings, and with that privacy which is so material a consideration in the large class of cases where the issue is prosaically simple, and nobody wants to attract public notice, are the very tribunals for solicitors. The author then gave an account of the methods of the London Chamber of Arbitration, and, on the crucial question of its success, he remarked cautiously that "the time which has elapsed since the inauguration "of the Chamber has been too short to judge of its "probable popularity and ultimate success." In the discussion which followed the reading of the paper, Mr. F. K. Munton, a member of the Council of the Society, and also of the London Chamber of Commerce, expressed the sentiment which doubtless animates the profession generally by saying that, while members of the Society might fairly recognize the Chamber of Arbitration by not dissuading clients from permitting such arbitration clauses from being inserted in contracts if they are so minded, "they could not with any propriety identify themselves "with a proposition to remove their clients' disputes from "the ordinary tribunals of the country." Mr. Blythe also remarked that the paper rather suggested a policy of despair, because the author contended that the Law Courts were unable to do the duty which they owe to the country. This was admitted. But the argument in defence appeared to be that the Courts are, after all is said, merely agencies for doing certain work for the community at large; and when these have lost the favour or the confidence of the people, the remedy rests with them. Curiously enough, a paper was read before the same meeting bearing the suggestive title "Legal Fictions," in which the author put the question whether the legal profession has really advanced in honesty of purpose and desire to act justly and with integrity. The answer to this inquiry is the Court of Arbitration.

British Colonial Coal and Petroleum at the Chicago Exhibition.—According to the list of awards made at the Chicago Exhibition, New South Wales received twenty for bituminous coal and petroleum cannel coal; Nova Scotia one, for a collective exhibit of coal; Canada three, for a collective exhibit of coal, for bituminous sand, and for mineral tar; and British Columbia two, for bituminous coal.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 734.)

Again the Stock Exchange has passed through a quiet and uneventful week. Business in general has been much restricted; and the disposition to remain inactive and await some further manifestation as to how the future is likely to shape, was pretty well as strong as ever. Prices have not made any considerable change, and, for the most part, were firm. Signs that the protracted coal strike was at last coming within measurable view of its termination, and that work and traffic would be resumed in the near future, had a beneficial effect wherever the wide-spreading influence of the disastrous stoppage has been felt. Various incidents also favourably affected the Foreign Market. But the removal of one great depressing factor—the American silver bugbear—has failed to make the anticipated progress, and that has been the darkest spot in the week. The fortnightly settlement was a light one, and produced no difficulties. The Money Market is dull; the supply being in excess of the demand. In the Gas Market, business has been extraordinarily quiet; the volume of transactions being most meagre, even when all due allowances are made. However, notwithstanding its inactivity, the market has been remarkably firm; and a large number of issues have advanced in price, while only one has retrograded. The chief feature is the large upward stride taken by Gaslight debenture stocks, which have attained a position far in advance of any point previously reached. Indeed, the 4 per cent. debenture stock is now pretty well abreast of Water debenture stocks, which always used to have marked precedence. Reverting to the general list, Gaslight "A" has checked its fall, and also made some show of a slight recovery; the later prices being rather better than the earlier. The preference and limited issues were very firm; and all, except the very small issues, advanced their quotations. Transactions in South Metropolitans were moderate, and not remarkable. Commercials were hardly touched; but they showed a nice rise on *ex div.* adjustment. The Suburban and Provincial list participated in the general strength; Brentfords making a moderate advance. Continentals moved irregularly; for, while Imperial continued depressed, European improved. In South Americans, the promising report of San Paulo, coupled with the dividend, sent the quotation up. Melbourne debentures responded to the better tone of local affairs by a rise of 1 in the scale. The Water Companies showed their usual quietude; but most of them made further improvement in value.

The daily operations were: The Gas Market opened quietly, and business was very slack all day. Brentford old rose 2; ditto new, 1; and European, ½. Tuesday's dealings were slight. Melbourne advanced 1; but Imperial Continental receded 2. In Water, New River rose 2; and East London, Grand Junction, and Southwark, 1 each. Wednesday was still quieter; and the only move was a gain of ½ by San Paulo. On Thursday, there were not half-a-dozen transactions recorded. Grand Junction rose 1. On Friday, Gaslight secured issues advanced all round, as shown in the list on p. 734. In Water, Chelsea and Southwark ordinary went up 1 each; and ditto "D," 3. On Saturday, the advances already score d were well kept up; but no further move was made.

ELECTRIC LIGHTING MEMORANDA.

The City of London Electric Lighting Company and the Commissioners of Sewers—Electrical Prophets—Danger no Object in Electrical Power Schemes—A Comparison of Gas and Electric Light at Chicago.

It is an unfortunate circumstance for the City of London Electric Lighting Company that they should have tried to overreach the City Commissioners of Sewers by laying down telephone tubes in conjunction with the conduits for their electric light wires. It was a piece of sharp practice which doubtless seemed to the Company a clever bit of business; and it is easy to understand how the Directors excused themselves for becoming parties to a device originated by their Executive with the laudable object of having two strings to their bow. When the Company submitted to the Commission the first plans of their proposed underground wiring arrangement, there was no sign of their intending to make provision for other than their own lighting cables. There was, however, a second set of plans prepared and deposited in the ordinary course, which showed a considerable addition to the number of tubes. It came out upon inquiry that the ostensible purpose of these tubes was to contain telephone wires for use in connection with the ordinary working of the Company; and the plans were passed—the matter of a few tubes more or less in a conduit being apparently regarded as of no moment. Meanwhile it transpired that the extra tubes were in reality meant to be leased out to a new Telephone Company. Thereupon the Electric Lighting Company were accused by the Commission of having acted *ultra vires* in this respect; and there was a great uproar. Many

members of the Commission scented another "job" in this arrangement; and the antecedents of the Lighting Company not being absolutely reproachless, it was impossible to dismiss the cry as groundless or uncalled for. Eventually it was decided between the Commission and the Company that these telephone tubes should not be used without the consent of the Commission; and here the matter rested for a season. Trouble arose again last week, however, when, in full meeting of the Commission, Mr. J. Harris, a member of this body who has consistently opposed the machinations of the electric lighting speculators, put the question whether or not the telephone tubes were being used surreptitiously. The impeachment was not seriously denied; and accordingly Mr. Harris moved that the question should be referred to the Streets Committee for investigation. This was opposed by the friends of the Electric Lighting Company; but the motion was eventually carried by a large majority. The decision probably means little more than a protest against the usurpation by the Company of the right to make an income by letting subways under the City streets; but it is bad for the Company to be at cross-purposes with the public lighting authority.

The tendency of electricians to draw upon the future is apparently ineradicable. Not content with claiming that electricity is destined to light the world, and to do all the manufacturing, chemical, and transport work of future ages, electricians are fain to exercise their prophetic powers within their own established connection; and so we find an American critic of the proceedings at the recent Chicago International Congress of Electricians interpreting these as indicating that "the alternating system, in spite of the bitter and unscrupulous opposition which it was compelled to encounter during the first years of its employment in this country, is surely destined to be the system of the future. In fact, appearances indicate that the direct-current system of distribution, so far as central station work is concerned, has already been definitely abandoned, at least in the United States." It is a great pity that writers upon electrical subjects will not confine themselves to the statement of facts. It could easily be shown that the present does not belong exclusively to any one system of electrical distribution; and why the future should be more one-sided is not altogether apparent. It may well be that the alternating system is more talked about just now at electricians' congresses than the other; but it might be argued that in this instance silence is golden, and that the alternating men talk most simply because the onus of proof still lies heavily upon them.

In connection with the subject of the last paragraph, a statement has appeared respecting the prospective utilization of the power of the Niagara Falls by electrical power plants, which strikingly illustrates the different views taken of a question of this kind by public authorities on the two sides of the Atlantic. An electrician connected with the Niagara Falls enterprise told the Chicago Electricians' Congress that tenders had been received from all the principal electrical engineering firms in the world, and that the estimates of cost for continuous-current apparatus were in every instance largely in excess of those for alternating apparatus. "The distribution at Niagara will be either by means of overhead conductors or by bare wires carried in a subway. The latter system, however, will be very expensive, except for short distances. It is probable that overhead wires will have to be used, and that people will have to learn, by e xperience or otherwise, to keep away from them and let them alone." The euphemism contained in the last sentence is delicious. It being obviously unlikely that anybody who should gain experience by coming into contact with a wire connected with the Niagara power plant would thereafter be able to retail his information for the instruction of others, the world in general, or that portion of it which happens to have personal dealings with Niagara, is kindly permitted to learn the lesson of the advisability of leaving the wires alone by other means—that is to say, by seeing the electricity strike "the other fellow." And this is put forward as perfectly right and proper. The Company will "have" to adopt a certain system of distribution merely because it happens to be the cheapest; and the public will "have" to learn to keep out of the way. An Old World member of this same public would feel disposed to ask, with Shylock: "On what compulsion must I? Tell me that." Why should even the humblest individual walking the earth "have" to look out for himself in this or that particular, simply because it happens to please another man to "chase the almighty dollar" in a particular way in the neighbourhood of Niagara? This is a sample of the class of considerations that operate to prevent American practice in electrical engineering from being of the slightest guidance to dwellers in parts of the world where the liberty of the individual is better preserved as against the arrogance of corporations than is the case in the States.

The incandescent light plant at the Chicago Exhibition is stated to be capable of keeping 180,000 lamps of 16-candle power alight at once, if required, "which would be equivalent," says the *Engineering Magazine*, "to the consumption of more than 1,000,000 cubic feet of gas per hour." This calculation is correct enough, so far as it goes. What is required to be added to it, however, is the observation that no gas engineer yet born would make an equivalent plant, unless he was reasonably assured of getting more profit out of the job than the Chicago Exhibition authorities are likely to realize from any part of their enterprise, electric lighting included.

GAS ACTS FOR 1893.

In pursuance of annual custom, we herewith give a summary of the provisions of the Acts of Parliament relating to gas supply passed during the current year.

The New Swindon Gas Act dissolves and reincorporates with statutory powers a Limited Company formed in 1862 for the purpose of lighting with gas the district of the Swindon New Town Local Board and its neighbourhood, in the parish of Swindon and county of Wilts. The capital of the Company consisted of £30,000, in £1 shares, of which 17,000 were issued and fully paid up, and £15,000 had been raised by way of loan. The Company had bought land and erected gas-works, upon which they had spent upwards of £30,000. The Act defines the Company's district of supply, and fixes the capital of the statutory undertaking at £60,000, whereof £17,000 is the original capital to be converted into stock, and £43,000 is the additional capital, to be raised subject to the usual conditions, and borrowing powers. Sufficient new capital is to be issued during the first year to pay off the old loan of £15,000 or to reduce the amount within the authorized limits. The initial price for 15-candle gas is 4s. 3d. per 1000 cubic feet within the districts of the two Swindon Local Boards, and 4s. 9d. outside. The Company may allow discounts not exceeding 10 per cent. to consumers, in consideration of prompt payment or a large consumption; and they may require prepayment for gas supplied in certain cases, and on condition of allowing 4 per cent. interest on such payments. Power is given to the New Swindon Local Board to purchase the undertaking within seven years.

The Accrington Gas and Water Works Act enables the Company to raise £104,000 of "C" stock for the purposes of their gas undertaking, to bear 7 per cent. dividend and carry one-fourth by way of loan. As from the end of the present year, the Company are to keep separate accounts of the working of their gas undertaking, and the existing capital of the same is defined to consist of £100,000, whereof £4500 is to be called "A" gas capital, and the remainder "B" gas capital. For the purpose of keeping a separate account, the borrowed money is apportioned between the gas and water undertakings in the proportion of £25,000 to the former and £29,600 to the latter. The initial price is 3s. 6d. per 1000 cubic feet for 15-candle gas. The Altrincham Gas (Tramways) Act empowers the Company to raise £40,000 additional share capital or stock, and to acquire additional lands. Permission is given to the Company to supply gas-fittings, engines, and other apparatus; to sell gas for heating or motive power purposes upon agreed terms; and to allow discounts not exceeding 10 per cent. for prompt payment on large consumption. They may also erect dwellings for their officers and servants. From and after the expiration of two years from the passing of the Act, the maximum price of gas is to be 4s. per 1000 cubic feet. As from the next quarter-day after the passing of the Act, the gas supplied is to be 16-candle power. The construction and working of a tramway for animal power is sanctioned; the land to be acquired within one year, and the work completed within two years. The Brighton and Hove Gas Act extends the Company's limits of supply, and sanctions the erection of gas-works on additional lands. The Company may increase their capital by £200,000 in new £20 shares, or stock bearing a 7 per cent. dividend, with borrowing powers to one-fourth of the amount so raised. From and after the beginning of next year, 15-candle gas is to be supplied. Power is taken to sell gas for heating, power, &c., and also in bulk, upon agreed terms.

Certain of the provisions contained in the Crystal Palace District Gas Act were fully discussed in these columns while the Bill was passing through its several stages in the two Houses of Parliament. As the Act contains several clauses likely to find acceptance, in principle, with Committees on Gas Bills in the near future, we shall next week refer to this particular Act in more detail than is possible in the present article.

The Imperial Continental Gas Association Act enables the Association to increase their borrowed capital to one-fourth part of their share capital for the time being issued and fully paid up. It also enacts that all dividends accrued on the capital stock of the Association which shall remain unclaimed for a period of ten years shall be carried to the credit of the revenue account, without prejudice nevertheless to the rights of any person in respect of such dividends. The Staines and Egham District Gas and Coke Company's Preference Capital Act ratifies the creation and issue of certain preference shares of the Company, as to the validity of which doubts had at various times arisen.

The Wolverhampton Gas Act extends the Company's limits to include the parishes of Bushbury, Penn, and Codsall, all in Staffordshire. Additional lands are to be acquired and gas-works erected thereon, subject to the proviso that the Company shall not, without the written consent of the Electric Construction Corporation, Limited, manufacture on their present works, or on the scheduled lands, any chlorine, chlorine compounds, or any sulphuric acid "except to such extent (if any) as is produced by or in the manufacture of gas according to the ordinary methods in use in such manufacture." New capital amounting to £80,000 is authorized to be raised under the usual conditions. As from the end of the year, the profits of the Company are to be limited

to 10 per cent. on the original capital of £98,960, and 6 per cent. on the additional capital of £49,480 authorized by the Order of 1875, and 6 per cent. on the new capital if issued as ordinary capital, or 5 per cent. if issued as preference capital. The amount of loan capital is fixed at one-fourth of the aggregate total of the existing capital, inclusive of £10,000 which has been converted into stock, and £12,370 now owing on mortgage. The interest payable on loans is limited to 4 per cent. A section of the Act of 1852, prescribing the amount of the Company's reserved and contingent funds, is repealed; and power is given for the creation of a reserve fund out of divisible profits in excess of the standard, as rendered payable by the sliding-scale clause. The initial price for 15-candle gas, containing not more than 25 grains of sulphur in 100 cubic feet, on the average of three consecutive days' tests, is fixed at 2s. 9d. per 1000 cubic feet. A testing-place is to be provided within six months, on a site to be agreed upon between the Company and the Corporation. One such testing-place is to be fitted up and maintained by the Company; and if the Corporation wish for any more, they must pay for them. The Company are empowered to grant to consumers discounts not exceeding 10 per cent.; to supply fittings; and to sell gas in bulk. The power of purchasing the undertaking conferred upon the Corporation of Wolverhampton by the Act of 1852 is confirmed by this Act. The Company are authorized to construct a canal-basin, and to alter a certain watercourse.

The Barnoldswick Local Board Gas Act is to authorize the transfer of the undertaking of the Barnoldswick Gas and Light Company, Limited, to the Local Board. The Company obtained a Provisional Order in 1890; and their capital consisted of 1200 ordinary £10 shares, upon which £6 per share has been paid, and they had a mortgage debt of £1800. The agreement for the transfer is scheduled. It is stated therein that the consideration for the purchase was £13,850, together with any further expenditure on capital account from March 2 last to the date of the transfer, on which date the Company were also to be paid 2s. per 1000 cubic feet for all gas in stock, and all other stores and materials were to be purchased at invoice prices. Nothing in the scheduled agreement is to warrant the Local Board in supplying gas in bulk or otherwise within the townships of Thornton or Earby, or to affect the gas undertaking of the Mill Company, Limited, within those townships. Outlying local authorities are authorized to purchase portions of the undertaking within their districts. Gas of 15-candle power is to be supplied, at a maximum price of 5s. 6d. per 1000 cubic feet. A clause is inserted relating to consumers' notices, which requires that these shall be given 24 hours before the vacation of premises supplied with gas, in default whereof the consumer is to be liable for all gas consumed up to the ensuing meter-taking. Notice of the provisions of this section is to be endorsed on every demand note for gas sent out. The Local Board are authorized to borrow the sum of £14,500 for the purchase of the undertaking, besides the ascertained costs of obtaining the Act.

The Barry and Cadoxton Local Board (Gas and Water) Act empowers the Local Board to purchase the undertaking of the Company according to the terms of a scheduled agreement. The sum of £149,000 is the agreed price for the property, and this is to be divided as between the gas and water undertakings by Mr. Charles Hawksley. The sum of £3000 is also to be paid for division among the Directors and Solicitors of the Company as compensation. The permanent irredeemable debenture stock of the Company remains as a first charge upon the undertaking and on the rates. The Pontypridd Local Board Gas Act authorizes the Local Board to purchase the undertaking of the Pontypridd Gaslight and Coke Company (incorporated by an Act of 1850), at the price of £35,000. The maximum charge of 5s. per 1000 cubic feet is fixed for 15-candle gas, subject to discounts not exceeding 12½ per cent. The Todmorden Local Board Gas Purchase Act authorizes the transfer of the undertaking, which was carried on under an Act of 1871, for the sum of £66,462, subject to a mortgage debt of £10,000, to be cleared off within two years. Gas of 16-candle power is to be supplied; and it is to be charged for under a graduated scale of discounts rising to 12½ per cent. The Aberdeen Corporation (Gas and Water) Act gives authority to the Corporation to take additional lands and extend their gas-works; the power of compulsory purchase to be exercised within two years. The sum of £90,000 is to be borrowed for gas purposes. The St. Helens Corporation Act contains provisions for extending the gas lands. The Stockton-on-Tees Corporation (Gas) Act enlarges the limits of supply, and authorizes the borrowing of £68,000 for gas purposes.

The London County Council (Subways) Act empowers the Council to require pipes, &c., to be put in the subway of any street containing such convenience, upon giving seven days' notice to the owners of such pipes. Where subways exist, the right of Companies to break up street surfaces is to cease, except for removing pipes into the subway. Pipes in subways are to be kept in proper order; and a charge for the use of the subways may be made. It is provided that, in the case of a gas company having statutory powers to break up streets, such charge shall be determined with regard to the saving (if any) which may result from the substitution of subway for underground pipe-laying, taking also expenses of management and supervision into account.

NOTES.

A Remarkable Induction Effect.

Many wonderful stories are told of fires originating mysteriously; but a tale of this kind narrated by Mr. Arthur Annesley Voysey in the pages of *Industries and Iron* will be hard to beat for strangeness coupled with intelligibility. Mr. Voysey states that in the course of a thunderstorm that broke over a country house some miles from Nottingham during the night time, a table in one of the rooms was partially burnt—as was supposed, by a stroke of lighting. It was a table about 2 feet square, standing in a corner of a room, not touching the walls or anything else by a clearance of about 6 inches. The table was near an outer wall; but there was no pipe near, and the house had no lightning conductor. The table was ornamented by a stuff fringe secured to its edge by nails; and this fringe had been burnt off one side, and the wood was charred. There was no indication that a lightning discharge had entered the room. The question was, What had injured the table? It was ascertained by examination that the fringe consisted of a fluffy stuff, interspersed with fine metallic threads—a very general material in modern upholstery. The conclusion arrived at by Mr. Voysey was that in this case of mysterious fire-damage the explanation lay in the combination of metal threads with highly inflammable stuff. These threads were, according to his view, acted upon inductively by the lightning discharges taking place near the house. This inductive action was sufficient to cause small sparks to fly between the various threads; and the sparks set the inflammable material on fire. As Mr. Voysey remarks, if the fire caused in this particular manner had not quickly died out, the whole house might have been destroyed, and no sign of the true cause would have been left. He goes on to observe that it is not unusual for fires to occur in connection with thunderstorms; and though these are generally attributed to the direct action of a lightning discharge, it may well be that some of them are caused by induction.

Gas Leaks Lighted by Induction Sparks.

It is a striking concidence that during the same week that witnessed the publication of the communication which forms the subject of the preceding "Note," Professor John Trowbridge sent to another contemporary a statement relating to an incident witnessed by himself during a visit to a country hotel, lighted by incandescent electric lamps, which is concerned with the ignition of an escape of gas by induction during a thunderstorm. As the storm was in progress, Professor Trowbridge noticed that the electric lamps blinked at every lightning flash, though the storm was remote. This effect was doubtless due to the induction, produced by the surging of the lightning discharges. At last there came a heavy discharge, and the lamps went out, though no fuse was burnt. In the darkness, an attendant was able to discover that a jet of gas from a pinhole leak in the fittings had been ignited, doubtless by a minute electric spark, and the flame was impinging upon some adjacent woodwork. Here again what might easily have become a serious and mysterious conflagration was prevented. The moral of the story, as drawn by the electricians, is found in the reflection that had the electric light wires not been carried along the gas fixtures, as they were in this case, the ignition would probably not have occurred. It is remarked that if people will cling to their gas when they lay down an electric lighting system, it behoves the electrical engineer who superintends the work to see that the wires and the pipes are never contiguous; for no lightning guard or other protector yet invented can ensure that minute sparks, due in some cases to resonance effects, may not arise. It may be remarked upon this caution that probably people will continue to run this infinitesimal risk so long as they are called upon to face the more imminent danger of accidental extinctions of the electric lamps.

The "Gas and Air Commingler" Again.

How hardly delusions die, when anybody is interested in keeping them alive, is shown once more by the reappearance, in a recent number of the *Engineer*, of a complaisant notice of the so-called "gas and air commingler" introduced to the confiding British public by the New Caloric Syndicate, which was noticed and condemned in our columns so long ago as Oct. 6, 1891. This precious article starts with the statement that "an apparatus for thoroughly mixing gas and air in combustible proportions, and suitable for use in many industries, has long been desired." Then comes a description and illustration of the "commingler," which is nothing more than the ridiculous arrangement of pumps and a perforated gas-pipe opening by multitudinous small holes into an air casing exposed in our notice of the abortive "experiments" instituted at the time already referred to at an establishment in the Southwark Bridge Road. These experiments came to an untimely end, partly owing to the circumstance that some of the gentlemen invited to the "press view" of the test which had been carefully prepared to demonstrate the superiority of the mechanical "commingler"—which consisted of keeping up steam in a Cornish boiler—proved most unexpectedly curious as to the reading of the gas-meter, and declined to accept the assertions of interested parties respecting the quantity of gas consumed. Now the venture has reappeared without change; and those interested

in it are to be complimented on their perseverance, which might well have been better exercised in a better cause. The atmospheric gas-burner is all the gas and air commingler that the public want.

Amalgamation of Collieries.—According to *The Times*, an important amalgamation of South Wales collieries has just been completed; the firms interested being Messrs. D. Davis and Sons, of Ferndale, whose output is 1,000,000 tons per annum, and Messrs. Tylor and Co., whose output is upwards of 250,000 tons. New pits are being formed which will bring the total output to more than 2,000,000 tons per annum.

Books Received.—"An Analysis of the Accounts of the Metropolitan Water Companies, for the Year ended Dec. 31, 1892, and March 31, 1893." By Alfred Lass, F.C.A. (London: Walter King.) This is the thirteenth year of publication of Mr. Lass's valuable Analysis; and the general arrangement of the tables adopted in the previous issues has been preserved in the present one. Appended to the tables are the rates of supply, the Companies' statutory powers as to dividends, the Water-Rate Definition Act, 1885, and the Water Companies (Regulation of Powers) Act, 1887.——"Provisional Orders of the Board of Trade." By F. J. Crowther. (London: Jordan and Sons, 120, Chancery Lane.) This is a manual of practice for promoters, opponents, and others, by a Parliamentary Agent whose experience has extended over nearly a quarter of a century.——"The Registration of Transfers." By G. and G. F. M. Ennis. (London: Effingham Wilson and Co., Royal Exchange.) This work, the authors of which are both barristers of the Middle Temple, is an attempt to mark out some of the courses which may reasonably be adopted to efficiently safeguard the interests of transferees and of the body of which they propose to become members. There is a chapter on the Forged Transfers Acts; and an appendix of forms for directors, secretaries, and others.

The Fertilizers and Feeding-Stuffs Act.—Reference has already been made in the JOURNAL to the measure introduced early last session to amend the law with respect to the sale of agricultural fertilizers and feeding-stuffs. The Bill has now become an Act. By the first clause, it is enacted that every vendor of a fertilizer manufactured in the United Kingdom or imported from abroad shall give to the purchaser an invoice, stating, as nearly as he can, the percentage of the nitrogen, soluble and insoluble phosphates, and potash contained in the article, and that this invoice shall have effect as a warranty by the seller. If anyone fails, without reasonable excuse, to give an invoice, or if the description of the material is false to the prejudice of the purchaser, the offending person is liable, on summary conviction, to a penalty not exceeding £20 for a first offence, and £50 for any subsequent one. A certificate of the Board of Agriculture is an essential preliminary to legal proceedings, except in cases where they are instituted by the council of a county or a county borough. County councils are to appoint district agricultural analysts; and buyers of fertilizers will be entitled, on payment of a fee, to have their purchases analyzed. This analysis, subject to appeal to a Chief Analyst to be appointed by the Board, may be made the basis of proceedings by the person aggrieved, by a county council, or by any association authorized by the Board in that behalf. Any person aggrieved by a summary conviction is to have the right of appeal to Quarter Sessions. The Act extends to Scotland and Ireland, and is to come into operation on Jan. 1, 1894.

Resignation of Mr. Magnus Ohren.—Mr. Magnus Ohren has resigned the position, which he has held for a period of 38 years, of Secretary to the Crystal Palace District Gas Company; and his resignation has been regretfully accepted by the Directors. Mr. Ohren is in his 72nd year; having been born at Rotherhithe on Dec. 8, 1821. He commenced his connection with the gas industry in 1837, when he was articled to Mr. Geddie Pearse, the Chief Engineer of the British Gaslight Company; and from 1846 to 1850 he was engaged in the work of lighting the city of Hamburg with gas. Mr. Ohren was next connected with the Commercial Gas Company; and in 1855 he was appointed Secretary and Resident Engineer of the Crystal Palace District Gas Company. He continued to discharge the duties of the joint offices until 1865, when they were divided, owing to the extraordinarily rapid growth of the undertaking; and he has since held the former post alone. During the time Mr. Ohren has been connected with the Crystal Palace District Company, he has witnessed the consumption of gas doubled over and over again. In the year 1859, Mr. Ohren was admitted an Associate Member of the Institution of Civil Engineers. He is a Past-President of The Gas Institute; a member and one of the founders of the Society of Engineers; a Fellow of the Chemical Society; and a Fellow and one of the founders of the Sanitary Institute. Speaking generally, it may be truly said that for a generation Mr. Ohren has been one of the best known and most respected and popular members of the gas industry of the United Kingdom. He is also an eminent Mason, and was largely instrumental in founding the Evening Star Lodge, of which he has been Secretary since the commencement, and has worked through the Chair. For some time past Mr. Ohren has been in failing health; and his retirement from active work is due to this circumstance. We sincerely hope he will live long to enjoy his well-earned leisure.

TECHNICAL RECORD.

NORTH OF ENGLAND ASSOCIATION OF GAS MANAGERS.

Mr. G. R. Hislop's Patent Regenerative Retort-Settings.

In last week's issue, we gave a report of the general business transacted at the meeting of the above Association on the previous Saturday, with the address delivered by the President (Mr. David Terrace, the Engineer of the Middlesbrough Corporation Gas-Works). We now complete our record of proceedings by publishing the discussion on the paper on "Hislop's Regenerative Retort-Settings" which was prepared by Mr. Er W. Smith (Cockermouth), and read, in the absence of the author, by Mr. H. Lees (Hexham), at the April meeting.

The PRESIDENT, at the outset, suggested that perhaps it would be better if Mr. Smith would epitomize his paper, and so open the way for the discussion.

Mr. SMITH said he must confess to feeling somewhat strange before the members, because though he had been connected with the Association for about five years, he was sorry to say—and he looked upon it as his misfortune—that this was only the second occasion he had been among them, and there were very few faces that he knew. In giving a *résumé* of his paper, perhaps he should commence with the most distinguishing feature of the settings under consideration—viz., the comparatively shallow producer and sunk chamber. In the settings of sixes which they had at Cockermouth, the total depth of the sunk chamber was only 4 ft. 10½ in.; and this rendered practicable their adoption in places where any deeper furnace, perhaps, would not be suitable—such as where water was likely to be met with in the foundations. The producer was 2 ft. 8 in. wide by 4 ft. 7¼ in. high. The ash-pans were arranged one on each side of the producer; and there were no fire-bars. The secondary air supply was admitted through suitable openings on either side of the furnace; and the primary air through discs at the ash-pan doors, which enabled the quantity needed to be very easily regulated. The waste gases, after the products of combustion had done their work in heating the retorts, were conveyed down each side of the oven and sunk chamber to a flue under the ash-pans, and made to do extra duty in the evaporation of the water required for the furnace. There had been no difficulty so far with these settings in obtaining sufficient steam from the pans to keep the clinker friable. In their general working, he might say they had been able to burn off the charges in four hours. The clinkering of the furnaces was very easily carried out; being a matter of only a few minutes' labour, and this only at periods of 48 hours. The production of gas per mouthpiece had been about 7000 cubic feet per 24 hours. This result was very good, when it was remembered that the quality of coal used was very much inferior to that of Northumberland and Durham. The yield of gas per ton of coal before these settings were introduced was very much below what it was now. The fuel account had reached the low figure of 11 lbs. per 100 lbs. of coal carbonized. He was able to add some little information to that given in his paper as to the cost of the settings; one or two more recent cases in which these furnaces had been adopted having now come under his notice. In one instance where a bench of 64 retorts was in course of erection, the total cost, inclusive of everything except excavation, worked out at about £33 per mouthpiece. This was very much lower than the figures quoted in his paper, which were supplied to him by Mr. Hislop, and would doubtless refer more particularly to prices in his district. In another case where everything had to be found for the erection of 18 retorts on the Hislop system, except nine new Tangye's mouthpieces, nine ascension-pipes, and the hydraulic main, the total cost was only £527 11s. 9d., which worked out to about £29 10s. per mouthpiece. These figures included the taking down of the old bench, carrying a flue across the retort-house, cutting new openings in the hydraulic, and all other incidental charges incurred in introducing the new work.

Mr. J. HEPWORTH (Carlisle) remarked that he heard the paper read last April; and it struck him as being a very excellent contribution to their proceedings. He thought it was the first upon regenerative furnaces which had been submitted to the Association; and, as it came to them from a works of no great size, it appeared to him to be the more interesting. The advantages of the regenerative setting in large works had long been admitted, and oftentimes illustrated; but, in the case of small works, it had been somewhat more difficult to see an advantage, such as Mr. Smith had derived by its introduction. He thought, however, the paper clearly showed that the advantages had been very considerable; and now there could be no two opinions as to the benefit to be obtained by adopting regenerative furnaces in some form. It had practically come to a question of pounds, shillings, and pence; and if, by this or another method, they could secure results at a lower figure than they were at present accustomed to, then the wisdom of adopting regenerative settings was evident. Mr. Smith in his paper said that the coke used as fuel had been brought down to 11 lbs. per 100 lbs. of coal carbonized; and they would all agree that this was a very excellent result. He was talking to a gentleman not very long ago, who startled him by stating that his fuel account

had now reached the very low figure of 9 lbs. He himself had had some experience with regenerative settings; but he was bound to say he never reached 9 lbs. If, however, they could reduce the consumption of fuel from 25 lbs. to anything like 16, 14, 11, or 9 lbs., then they would do a great deal in promoting the prosperity of their undertakings. He had been looking, for some time past, for a less expensive system of regenerative furnaces. He thought it was possible to hit upon a cheaper method than had been introduced to them by Mr. Smith; but it was entirely a matter for the consideration of engineers, taking all local circumstances into account. The figures which had just been quoted by Mr. Smith very largely modified the question as to cost, in comparison with those given in the paper itself; and the fact that Mr. Smith could tell them of settings on Mr. Hislop's method being introduced at a cost of something like £29 10s. per mouthpiece showed that a very substantial advance had been made. If they could bring the figures somewhat lower, and adopt a furnace which would reduce the cost to about £10 per mouthpiece, they would then have reached the goal.

Mr. J. Whyte (Seaham Harbour) said he was very pleased that Mr. Smith had brought this subject before the members, because he did not know of another works in the North of England where such a system was in operation. He knew of other places where it was at work; but they were using a different class of coal. He was aware that some of the members were halting between two opinions, and did not know which method to adopt. For his own part, he some time ago introduced Frith's settings. At first, he was very much disappointed with them; and if it had not been for the very great expense, he would have gone in for Mr. Hislop's settings, even after he had adopted Frith's. He could not speak to his fuel account being so low as Mr. Smith's; but he charged on the six-hour system, and the yield was 6000 cubic feet per mouthpiece per 24 hours which he thought was fair. But there was one thing that had to be said in favour of the settings he had adopted, and that was that they were not very expensive. The great difficulty he had seen all along with Mr. Hislop's settings was the expense in their erection.

Mr. W. Airth (Morpeth) observed that he commenced the use of Mr. Hislop's furnaces a month previously; and he might say, with Mr. Whyte, that he expected better results. It had been a failure on his, or someone else's, part. He could only get the light tars into the hydraulic main; and they had a good many stoppages in the ascension and bridge pipes. He found that the tar collected like soot. He could take it away with his hand, like a ball; and, in fact, it hardly left any tarry matter on his hand. Their President had been to see the settings, and had given him two or three wrinkles. He had also had a visit from Mr. Hislop, who advised him to put in steam. Up till then he had flushed with water; but he had now adopted the suggestion. One of his Directors and his son were sent to inspect several systems; and they came to the conclusion that Mr. Hislop's was the best. For his own part, he was not sorry he had adopted it; still he would like to see it working better. He could get any amount of heat, and that was what he wanted, because he was anxious to have four-hour charges. On making inquiries, he found that there were others who were bothered in the same way as himself. However, he thought Mr. Hislop's system was about the best that could be adopted for small works; and he had no hesitation in saying that in a short time he would get it to work to perfection.

Mr. G. Airth (Morpeth) pointed out that sometimes stokers had a prejudice to a new system. At the Morpeth works, they formerly had round retorts; and he found, when they began to use the Ω-shaped retorts, the stokers thought they would have to put more coal into them. He had now started a bench on five-hour and heavier charges than were given in Mr. Hislop's instructions; and he found that the tar which remained was very little. He thought the tar became cold in the main; but, with the introduction of steam into one end, this was improved. He considered Mr. Hislop's settings were much better than any on the old style.

The President remarked that the more complicated a system was, the more care it necessarily needed; but, when some points of detail were overcome, they felt they had done right in adopting it. There were, however, certain things that they must see to, and counteract, and correct, before they had what they desired. They knew that this had frequently happened, and that it was sometimes sufficient to "stand back," as it were, an invention; but it was well to try to overcome any drawbacks they might discover. He was very pleased that members had spoken so freely in the discussion, and had stated their difficulties, because it was only by doing so that they could ever arrive at any satisfactory conclusion.

Mr. Smith, in reply, said he was glad the paper had raised this discussion; and he was particularly pleased that his friend Mr. Airth had taken part in it. With reference to the heavy expenditure which the adoption of the system would require, and its bearing on small works, he could only say that very often, in the selection of new work, first cost was considered more than efficiency. He believed Mr. Hislop's setting was the most satisfactory he had seen in operation. Probably the quantity of ironwork needed to make it so efficient brought up the cost considerably above a setting in which very little ironwork was required for the producer. With reference to Mr. Whyte's remarks, that gentleman had referred to six-hour charges, and a production of 6000 cubic feet of gas per mouthpiece; but he did not give the fuel account. It seemed to him that six-hour charges were not a very great advance on the ordinary open furnace. With regard to Mr. Airth and his troubles, he was sorry he had suffered so much from stopped ascension-pipes; but he could assure him that he was very much troubled himself in that direction during the first three months or so, and he hoped that the few hints he might be able to give Mr. Airth would enable him to overcome the difficulty. He thought that Mr. Airth's son had struck the right nail when he spoke of the introduction of steam into the hydraulic main to keep the tar hot. He had known instances where the tar cooled down, which prevented it getting away, so that the dip of the seal was raised, and trouble followed with the ascension-pipes. In such cases he lowered the seal by first forcing away the stiff tar by the aid of steam. For a while he had found it necessary to do this at regular intervals, particularly in very cold weather. He removed the cap of the dip-pipe nearest the tar outlet, and allowed a jet of steam to play into it for about ten minutes. Taking all the dip-pipes in order, they found, by the time they reached the portion of the hydraulic main immediately over the retorts in action, that they had cleared away most of the obstruction, and their troubles with stoppages ceased. By this means, he lowered the dip; and, until it began to rise again, they were free from stopped pipes. But, as soon as the tar began to thicken, and the dip to rise, the stoppages re-commenced. He thought with the President, that, in working most new inventions, very often little troubles and difficulties occurred which might be overcome with perseverance. Such an experience as Mr. Airth was going through was exactly what many others had undergone, and it was incidental to high heats; but, by taking due precaution, his difficulties might be greatly lessened, and perhaps ultimately overcome.

CARBURETTING ILLUMINATING GAS.

The address on this subject delivered by Dr. H. Bunte, of Karlsruhe, at the thirty-second annual meeting of the Association of German Gas and Water Engineers, held at Kiel, has been printed in the *Journal für Gasbeleuchtung*, from which the following slightly condensed translation has been made.

The result of observations lately carried out on the carburetting of gas—*i.e.*, increasing the illuminating power by means of hydrocarbons—is here given. Coal gas, like other illuminating gases, such as are made from oil and fats, owes its illuminating power chiefly to the presence of gaseous or vaporized hydrocarbon compounds, which are formed in varying amounts by the decomposition of organic substances by heat. These different kinds of hydrocarbons, which are usually classed together under the title of "illuminants," or "heavy hydrocarbons," fall under three series, of which the first members—methane, ethylene, and benzene—are important constituents of coal gas, as is evident from Table A, given on p. 720. To each of these first members a series of homologues corresponds, in which the boiling-point ascends, and the specific gravity increases, with the greater number of carbon atoms. This also will be seen for the lower members of the series in the table. Excepting, as unimportant for our present purpose, the intermediate members, the gaseous methane is followed by butane—a hydrocarbon with four carbon atoms, which is gaseous at ordinary temperatures, but condenses to a liquid at about 0°C. Next comes pentane, with a boiling-point of 37° C.; and then hexane, heptane, and octane. These hydrocarbons are all of them constituents of crude petroleum, and, on account of their easy volatility and inflammability, are removed as petroleum ether, gasoline, carburine, &c., in the preparation of burning oil. The series goes on until the higher boiling liquids which form the bulk of burning and lubricating oils are reached; and, finally, to the hydrocarbons like paraffin, which are solid at ordinary temperatures. The second series, which starts with ethylene, comprises the olefines, or "unsaturated" hydrocarbons, which somewhat resemble those of the methane series in physical properties. The members, especially the higher ones, are little known, and, like those of the first series, are found in some kinds of petroleum, as well as among the distillation products of cannel, Boghead shale, and resin. The third series starts with benzene—a liquid boiling at 80° C., and with six carbon atoms to the molecule. To its vapour, coal gas mainly owes its illuminating power. The series extends from it to the heavier liquid homologues—toluene, xylene, &c.—which are for the most part obtained from tar. The boiling-point rises with the increase in the number of carbon atoms in the molecule.

The enrichment of illuminating gas, or carburetting, will be best elucidated by the addition to coal gas of hydrocarbons of the three plainly characterized series, with a view to raising its lighting power. There would be no limit to the amount of the addition if these hydrocarbons were all, like ethylene, gaseous at ordinary temperatures; but from the table it is evident that most substances available for carburetting are then liquid. In the first place, therefore, it must be established what quantities of their vapours can be added to coal gas without separation taking place at the lower temperatures to which it is

exposed during distribution. To illustrate the conditions, the following table has been prepared for benzene, and the diagram (fig. 1), based on Lacey's researches,* for two very volatile petroleum distillates in addition. These distillates are gasoline, boiling at 40° C., consisting mainly of pentane; and carburine, boiling at 60° C., consisting chiefly of hexane. The table and diagram show the quantities of vapour, calculated from the vapour tensions, which can be taken up by air or gas to the saturation-point, at various temperatures below the boiling-points of the liquids:—

Temperature.	Vapour Tension in Mm. of Mercury.	Percentage of Vapour by Volume.	Grammes of Benzene in 1 Cubic Metre.	Difference.
− 20° C.	5·79	0·76	26·5	
				13·9
− 15 ,,	8·82	1·17	40·4	
				18·9
− 10 ,,	12·92	1·70	59·3	
				24·7
− 5 ,,	18·33	2·41	84·0	
				32·1
0 ,,	25·31	3·33	116·1	
				40·4
+ 5 ,,	34·17	4·49	156·5	
				51·0
+ 10 ,,	45·25	5·95	207·5	
				62·7
+ 15 ,,	58·93	7·75	270·2	
				76·7
+ 20 ,,	75·65	9·95	346·9	
				83·1
+ 25 ,,	95·91	12·62	440·0	

One litre of benzene vapour, at 0° C. and 760 mm., weighs 3·4866 grammes.

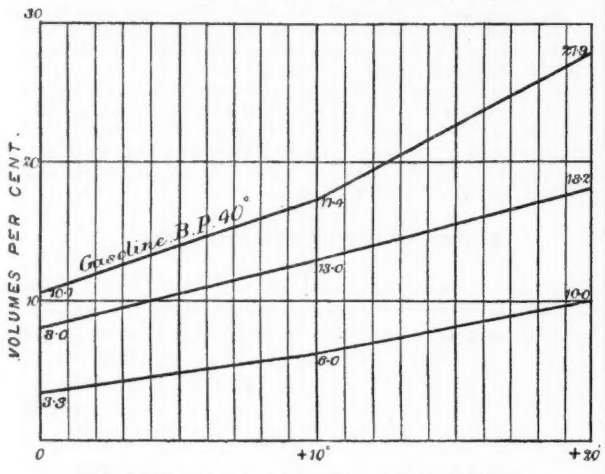


FIG. 1.—DIAGRAM SHOWING VAPOUR TENSIONS IN VOLUMES PER CENT.

For example, the vapour tension of benzene, boiling at 80° C., is equal, at 0° C., to 25·31 mm. of mercury; hence at that temperature the vapour can be mixed with air or gas until it amounts to (25·31 × 100) ÷ 760 = 3·3 per cent. by volume, or until 1 cubic metre of air or gas contains 116 grammes of benzene. If gas so saturated with benzene vapour at 0° C. is cooled to −5° C., a portion of the benzene, amounting to 32 grammes per cubic metre, is thrown down, and the gas contains only 2·41 per cent. by volume of benzene vapour, or 1 cubic metre (measured at 0° C. and 760 mm.) contains 84 grammes of benzene. Further cooling of the gas entails additional deposition of benzene in quantities calculable from the table. For temperatures above 0° C., similar conditions obtain. Thus, at 20° C., gas could contain 10 per cent. of its volume of benzene vapour; but, on cooling to 0° C., this would be condensed until the gas contained at that temperature only 3·3 per cent. by volume of the vapour. The other hydrocarbons behave like benzene; but, as the boiling-point declines, the vapour tension is raised, and gas can be mixed with greater quantities without separation ensuing at lower temperatures. Thus, hexane (carburine) would mix with gas at 0° C. until the latter contained 8 per cent. by volume of it; and gasoline would give 10·7 per cent. against the 3·3 per cent. of benzene.

Ordinary coal gas has in it a certain quantity of benzene, to which its lighting power is mainly due. The question, therefore, occurs whether further quantities can be added to gas without condensation taking place. Ordinary coal gas generally contains from 1 to 1·3 per cent. by volume of benzene, or 1 cubic metre at 0°C. and 760 mm. contains from 35 to 40 grammes. A comparison of this figure with that in the table, derived from the vapour tension (3·3 per cent. by volume, or 116 grammes of benzene) shows that coal gas only contains about one-third the amount of benzene which it can carry when fully saturated at 0° C. But in winter gas is exposed to lower temperatures than this; so, in order that its illuminating power shall be always sufficient, the limit of temperature for carburetting purposes should be taken as −5° or −10° C., instead of zero. But even at these temperatures, the table of vapour tension indicates that from 84 to 60 grammes of benzene can remain in the gas, which is considerably more than is actually present. There is nothing to prevent the increase of the benzene up to that limit; and therefore it may be regarded as a carburetting medium for coal gas.

The conditions are still more favourable for the other materials, the readily volatile petroleum oils; for coal gas does not contain an appreciable amount of them, and the point of condensation of the vapour lies lower. Experience proves that great quantities of vapour of gasoline, ligroin, &c., can be mixed with gas to raise its illuminating power, without a deposition taking place at lower temperatures. The natural limit is, of course, determined by the vapour tension of the carburetting material; and it is easy, by trial at the lowest temperature anticipated, to avoid passing this limit, and to prevent the troublesome deposition of condensation products.

Since members of the three groups of hydrocarbons may be applied to carburetting, the relative value of these different enriching materials for increasing the illuminating power of gas must be ascertained. Experiments undertaken to this end encounter considerable difficulties; for, apart from the variety of hydrocarbons, the illuminating power of a gas is not simply proportionate to the amount of hydrocarbon it contains. The light of the flame is produced by the high temperature developed on combustion splitting up hydrocarbons of the kind under consideration, setting free hydrogen, and depositing carbon, which is raised to so high a temperature that it emits light. The point to which the carbon is heated is indicated not only by the colour of the flame, which varies from dull red to clear white, but also by the intensity of the light. If also, on the one hand, the amount of carbon separated is in close dependence on the quantity of hydrocarbon vapours present, on the other hand the heating materials, by which the carbon is raised to a white heat, are not all equally good. Thus a different result will be obtained on burning hydrogen charged with benzene vapour to that of burning methane with the same quantity of carburetting material; and both results will differ from those of burning water gas or coal gas charged to the same extent with benzene vapour. The illuminating power is not only dependent on the nature and amount of the carburetting material, but also very considerably on the nature and quantity of the heat-producing gases, called, in distinction to the illuminants or carburetting matter, the "diluents" or carriers.

It is necessary, therefore, in order to ascertain the relative values of different carburetting materials, to take one gas, such as hydrogen or water gas, as the basis of experiments, and even then to bear in mind that the light developed is largely dependent on the method of burning. The kind of burner and the rate of consumption cannot be ignored in estimating the value of a carburetting substance. For instance, an Argand burner, with regulated air supply, gives the most favourable result when on the verge of smoking, since the supply of air is then at the minimum, and the liberation of carbon particles and the temperature of combustion at the maximum. Or if an Argand burner, constructed to consume 150 litres of gas per hour, be supplied with 120 litres only, the air supply, which is dependent upon the cylindrical chimney, will be too great for the smaller consumption, the flame will be cooled by the excess of air, and, the liberation and heating of the carbon being thereby detrimentally affected, the illuminating power will be low. To still further elucidate these conditions, experiments have been carried out, in which the composition of the products of combustion has been ascertained, in addition to the usual observations being made on the consumption and the photometric effect. It appears that the useful lighting as well as heating effect of the flame is highest when the amount of carbonic acid in the products of combustion is greatest; and that, the smaller the excess of air admitted, the greater the development of heat and light. To fulfil these necessary conditions, the gases, both before and after carburetting, were examined by consumption in an Argand burner when on the point of smoking. To establish a law for the relative values of carburetting materials, a very large number of experiments were carried out in the manner and with the results depicted below.

Experiments were made to ascertain to what temperature Karlsruhe gas can be cooled without depositing in appreciable amount the hydrocarbons it contains in a state of vapour. The average result of many experiments showed from 40 to 42 grammes of benzene and its homologues to be contained in a cubic metre of gas, which, when consumed at the rate of 150 litres per hour, had an illuminating power of 26 Hefner units. The experiments were carried out on the gas as supplied to the laboratory, and the influence of the cooling on the illuminating power was determined in relation to the deposition of the vapour. These may be termed "decarburetting experiments." The average results of a large number of observations are shown in the next table, and in the accompanying diagram (fig. 2).

To correctly estimate the effect of cold on the hydrocarbon vapours, it was necessary to maintain a constant low temperature for a considerable time. Consequently, freezing mixtures, of which the temperature rises gradually, could not be directly used. Saline solutions, in which salt was dissolved as it precipitated, were surrounded by a freezing mixture, and a constant temperature thus secured. The gas to be cooled was led through glass worms, which were immersed in the cold saline baths; and the hydrocarbon vapours were thrown down in the liquid state according to the temperature (−6° to −10° C.). The quantity of gas cooled, the amount of condensation products thrown down, and the illuminating power of the gas after

* See JOURNAL, Vol. LIX., p. 903.

Temperature.	Quantity of Hydrocarbon Vapour Separated.	Percentage Diminution of Illuminating Power.	
		Fishtail Burner.	Argand Burner.
Deg. C.	Grammes.	..	..
0	..	..	..
−3	..	..	..
−5	..	..	..
−6	0·23	..	2·3
−10	3·80	..	..
−10·5	..	..	3·8
−11·0	..	16·0	..
−13·0	9·90	..	..
−14·0	11·10	..	..
−15·0	13·10	37·0	17·0
−15·5	..	..	18·0
−16·0	13·80	..	..
−16·25	..	46·0	..
−17·0	14·00	..	..

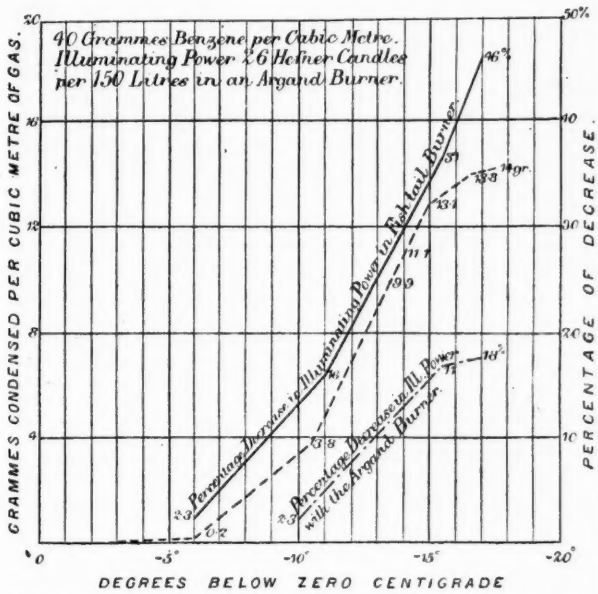


FIG. 2.—DIAGRAM SHOWING AMOUNT OF CONDENSATION PRODUCTS OBTAINED FROM KARLSRUHE GAS—JAN. & FEB., 1892.

cooling, were ascertained in the course of the experiment. The effect of cold on the hydrocarbon vapours, and the illuminating power of the Karlsruhe gas is clearly shown in the diagram (fig. 2). At a temperature of −5° C., little or no action takes place; but below that the lighting power of the fishtail burner shows diminution, though the Argard burner is unaffected by a slight deposition of condensation products. The diminution in quantity of the deposited products corresponds in the case of the fishtail burner, at least to a certain extent, with the diminution in illuminating power referred to the lighting value of the original gas. With gas cooled to − 16° C., the diminution with the fishtail burner was 46 per cent.; but with the Argand burner, only 16 per cent. The burner appears, therefore, to considerably influence the lighting effect; and the Argand seems to give a greater development of light with a relatively bad gas than other burners. No positive results were obtained from experiments on the efficiency of burners with a heated air supply when used for poor gases. The products of condensation deposited consisted chiefly of benzene and toluene, with small quantities of higher homologous hydrocarbons. The gas of which the illuminating property had been partially destroyed could be restored to its original power by the addition of benzol. Only a comparatively small part of the vaporized hydrocarbons was removed and replaced by other hydrocarbons in these experiments.

To obtain a greater effect, the whole of the "illuminant" hydrocarbons were removed by chemical means from the gas in a second series of experiments. The gas, which gave a scarcely luminous flame, was then carburetted by other liquid hydrocarbons. The gas on which the experiments were carried out was a mixture consisting essentially of hydrogen, methane, and carbonic oxide, which remains when the heavy hydrocarbons—ethylene, benzol, and the homologues—are removed from coal gas. It was prepared by passing illuminating gas through a scrubbing apparatus of glass tubes charged with fuming sulphuric acid; and the gas on its exit showed an illuminating power of only 2 to 3 candles, with an hourly consumption of 150 litres in an Argand burner. Such lighting power as it possessed was due to methane and the small quantities of ethylene and aromatic hydrocarbons not completely absorbed. This non-illuminating gas was carburetted with the vapours of very volatile hydrocarbons, and the quantity of carburetting material and the illuminating power of the mixture were ascertained. For carburetting, the arrangement formerly used by Dr. Knublauch in his experiments on the lighting power of benzol was made use of. The poor illuminating gas was led through a meter, and then divided into two streams—one going direct to a mixing chamber, the other passing through a vessel containing the carburetting material, with the vapour of which it became saturated, and then passed to the mixing chamber, where it joined the stream led thither directly. The loss of weight of the vessel containing the carburetting substance gave at once the amount of hydrocarbon used during the experiment. The gas was led from the mixing chamber to a burner, where it was tested photometrically. Results of the researches are comprised in Table B (p. 720).

It will be observed that the figures are highly unfavourable to the fishtail burner, as it requires a very great consumption of carburetting material to produce a given lighting effect. On considering the numbers for the Argand burner, it will be noticed that increase in illuminating power requires a more than proportionally increased consumption of the carburetting material. Experience is confirmed that a gas can be raised from 12 to 14 candles with less expenditure of carburetting substance than a gas can be raised from 20 to 22 candles. The additional consumption of carburetting material is very considerable, especially with the Argand burner. As already noticed, this burner has the quality, so to speak, of making bad gas appear better than good; or it permits diluted mixtures of illuminating hydrocarbon vapours to be used with relatively greater yield of light than concentrated ones. With hollow-top slit burners, medium qualities of gas give a more regular result. The lighting power increases approximately in proportion to the carburetting material added. For these burners, therefore, one figure only for each substance is recorded in the table.

Especially interesting is the comparison of the consumption of different carburetting agents to give a similarly increased light. Thus, for 100 Hefner candles, we find, even on making the reservation that the numbers in the table are, on account of the difficulties of an exact comparison, only approximately correct, that, for the same weight, aromatic hydrocarbons raise the illuminating power in greater degree than the paraffin hydrocarbons. Thus, while 45 grammes of benzene will give 100 Hefner candles, 150 grammes of pentane, 110 grammes of hexane, or 100 grammes of petroleum ether are required to produce the same result. The great influence exercised by the conditions of combustion is seen by a comparison of the figures for the Argand and fishtail burners. With the first, the consumption rises with the greater lighting power, but diminishes considerably with the latter; so that with it a feeble illuminating gas requires about four times as much benzene for a unit of light as in the Argand burner, while, with a heavy gas of 37 Hefner candles, the consumption is little more than that of an ordinary gas burnt in the Argand.

We may now speculate on the causes of these differences in value of the types of hydrocarbons. But the data are hardly sufficient, and the degree of influence exerted on the light by different causes not yet well established. In any case, however, the value of a carburetting agent is in close association with its vapour density, and the number of carbon atoms in its molecule; and the aromatic hydrocarbons considerably surpass in lighting effect the low-boiling paraffins and the first members of the olefines. From this point of view, it is of interest to consider how, and with what result, it is possible to convert members of one series of hydrocarbons into those of another. By the application of heat to the homologues of methane and ethylene (that is to say, the paraffins and the unsaturated hydrocarbons) by leading them through white-hot tubes or retorts, it is possible to convert them into members of the aromatic series—benzene, toluene, &c.—which possess a considerably higher lighting efficiency. This conversion can take place not only with the easily volatile hydrocarbons of which the vapours occur in gas, but also with the oils of high boiling-point such as occur in burning petroleum and in petroleum residues. By heating, these may be split up into less complex atoms; and, with separation of hydrogen, they pass into readily volatile hydrocarbons of the aromatic series. The difficultly-volatile members of the paraffin series, the vapour of which cannot directly be incorporated in gas, can therefore be employed for carburetting it.

We have at the same time to consider the manner in which the amount of hydrocarbon vapour in gas can be increased by carburetting. This can be done in two ways: (1) By so-called cold carburetting, in which gas is more or less saturated with the vapours of ready-formed, readily-volatile aromatic or paraffin hydrocarbons to the required illuminating power. (2) By hot carburetting, which may take place in two ways—(*a*) by passing the vapours of easily-volatile paraffin hydrocarbons mixed with gas through white-hot tubes, whereby a part of the vapour is converted, by the splitting off of hydrogen, into aromatic hydrocarbons or "fixed;" or (*b*) with hydrocarbons of the paraffin series not themselves volatile, such as petroleum, petroleum residues, gas oil, paraffin oil, &c., or cannel and Boghead shales, which yield such oils on distillation. The oil is decomposed at a high temperature to an illuminating gas consisting of very volatile vapours and permanent gases, which is mixed directly with the gas to be enriched, or is even produced along with it.

On these two or three fundamental principles are based all the methods of carburetting, of which the number, taking into account details in working and in apparatus, is legion. Of the many kinds of apparatus for carburetting with benzene, &c., in the cold which have been fruitful of bad consequences when in

TABLE A.—*Hydrocarbons belonging to the Paraffin, Olefine, and Aromatic Series.*

	I.—PARAFFIN SERIES.	II.—OLEFINE SERIES.	III.—AROMATIC SERIES.
General formula	$C_n H_{2n+2}$	$C_n H_{2n}$	$C_n H_{2n-6}$
	Constituents of Illuminating Gas.		
First members	Methane ($C H_4$)	Ethylene ($C_2 H_4$)	Benzene ($C_6 H_6$)
Higher members—	*Important Constituents of Petroleum, Paraffin Oil, and Shale Oils.*		*Found in Coal Tar.*
Petroleum Ether, Gasoline, &c.	Butane ($C_4 H_{10}$), B. Pt. 1° C.	Butylene ($C_4 H_8$), B. Pt. — 5° C.	—
	Pentane ($C_5 H_{12}$), „ 37° „	Amylene ($C_5 H_{10}$), „ 36—40° „	—
	Hexane ($C_6 H_{14}$), „ 69° „	Hexylene ($C_6 H_{12}$), „ 65—70° „	Benzene ($C_6 H_6$), B. Pt. 80° C.
	Heptane ($C_7 H_{16}$), „ 98° „	Heptylene ($C_7 H_{14}$), „ 95° „	Toluene ($C_7 H_8$), „ 111° „
Ligroin	Octane ($C_8 H_{18}$), „ 124° „	Octylene ($C_8 H_{16}$), „ 120° „	Xylene ($C_8 H_{10}$), „ 140° „

TABLE B.—*Effect of Carburetting Gas of Bad Illuminating Power.*

Carburetting Materials.	Illuminating Power of 150 Litres of Gas.	Consumption of Carburetting Material for 100 Hefner Units.		Fishtail Burner.	
		Argand Burner.	Slit Burner.	Illuminating Power of Gas for 150 Litres.	Consumption of Carburetting Material for 100 Hefner Units.
	Hefner Units.	Grammes.	Grammes.	Hefner Units.	Grammes.
I.—*Aromatic Hydrocarbons* ($C_n H_{2n-6}$)—					
Benzene ($C_6 H_6$), B.P. 80° C.	17	30	45	5	127
	20	37		7	90
	25	47		16	80
Toluene ($C_7 H_8$), B.P. 111° C.	19	32	51	37	62
II.—*Paraffin Hydrocarbons* ($C_n H_{2n+2}$)—					
Pentane ($C_5 H_{12}$), B.P. 35°—40° C.	17	160	190	8	467
Hexane ($C_6 H_{14}$), B.P. 65°—70° C.	28	150		15	333
	28	..	170		
Petroleum ether, B.P. 75°—80° C.	15	90	160		
	24	100			
III.—*Unsaturated Hydrocarbons* ($C_n H_{2n}$) –	32	140			
Ethylene ($C_2 H_4$)	15	83	232	2	620
	31	136		14	260
				24	210
				7	140
Amylene ($C_5 H_{10}$)	25	90	120	32	150
				68	130

TABLE C.—*Quantity and Cost of Light from Different Carburetting Agents.*

—	Cannel Coal.	Thuringian Gas Oil.	Crude Petroleum.	Petroleum Spirit (Gasoline).	Crude Benzol.
(*a*) Gas from 100 kilogrammes, in cubic metres	35	55	67	..	..
(*b*) Illuminating power for a consumption of 150 litres of gas, in Hefner units	42	43	55	..	..
(*c*) Value ($a \times b$)	1470	2,365	3,685	..	..
100 kilogrammes furnish Hefner-hours	9800	15,800	24,600	62,500	167,000
100 Hefner-hours are furnished by kilogrammes	1·02	0·633	0·407	0·16	0·06
100 cubic metres, at 1 Hefner candle, are furnished by kilogrammes	6·80	4·23	2·71	1·07	0·40
100 kilogrammes cost .marks	4·40	12·00	9·35* / 15·35†	25	45
100 Hefner-hours cost pfennige	4·50	7·60	3·8* / 6·2†	4·0	2·7
100 cubic metres, at 1 Hefner unit, cost pfennige	29·90	50·70	25·4* / 41·6†	26·7	18·0

Note.—In the column headed "Crude Petroleum," the figures marked with a * are without duty; those marked with a † include duty.

inexpert hands, and when worked with improper materials, that lately adopted in the London gas-works in place of increasingly expensive cannel must be noticed. There must likewise be considered the method also adopted there of enriching with oil gas from Russian and American petroleum. All these methods have attracted much attention, as, on the one hand, the cost of the enriching materials formerly employed is too high in proportion to the gradually falling price of gas; and, on the other, the demand for more light and less heat from gas proceeds apace. The Welsbach light comes into opposition in a certain sense. But even with it the question of carburetting has considerable importance; for carburetted gas has a higher heating as well as lighting value, though the former is in general dearly obtained.

Now that the scientific principles of carburetting have been discussed, the cost of enrichment may be briefly considered. The question of what method of carburetting, under existing circumstances, and with due regard to market prices and possible fluctuations, most cheaply furnishes a light of (say) 100 Hefner units per hour, is an important one to the gas industry. A general answer cannot, of course, be given. Apart from the varying conditions under which carburetting must be conducted, the quality of the gas to be enriched, and the illuminating power to be attained, considerably affect the result of the inquiry. It is nevertheless of interest to consider, with certain data granted, what quantity of light is obtained from different carburetting agents, and to reply to the question of what is the cost of a definite amount of light—say, 100 Hefner-hours—independent of secondary expenses and bye-products. Such a computation has been made for certain carburetting materials in Table C. Five carburetting agents are considered. Three of them—viz., cannel coal, Thuringian gas oil, and crude petroleum—are employed for carburetting by heating; and two—viz., petroleum spirit, or gasoline, and crude 90 per cent. benzol—are used in the cold. The value of cannel coal is based on Herr Schiele's exhaustive researches; Thuringian oil and crude petroleum are valued at medium results; and for gasoline and benzol, the author's experimental results are taken.

As already stated, in these figures no account is taken of the secondary expenses, such as of firing, or of the bye-products, such as coke, ammoniacal liquor, and tar, with the first three materials. With these, too, actual working figures were employed; while for gasoline and benzol, the experimental figures (generally much too favourable) were used for the calculation. Nevertheless, the lower figures show that other materials besides cannel must be considered as carburetting agents. With Thuringian gas oil, 100 Hefner-hours cost 7·6 pfennige, against 14·5 pfennige by cannel coal; but the price of the oil, if required in quantity for gas enrichment, would be less than the 12 marks now obtaining. Likewise crude petroleum, duty paid, would give 100 Hefner-hours for 6·2 pfennige. Thus, in respect of price and value, neither Thuringian oil nor crude petroleum is to be ignored as an enricher. The agents employed for enriching in the cold are of special interest, as the cost of 100 Hefner candles is considerably less with them than with the others. Benzol, at the very low price of 45 marks per 100 kilos., is the cheapest carburetting material obtainable; as it will furnish 100 Hefner-hours at a cost of 2·7 pfennige.

For products that have to be purchased, the figures used in the calculation are too favourable, as the cost must increase if they are used in quantity; yet the result is sufficiently remarkable to demand close attention. Further, benzol is, in a sense, the natural carburetting agent for ordinary coal gas, since the original illuminating power of the latter was derived chiefly from benzol vapour. But it must be remembered that hitherto the greater part of the crude benzol has been obtained from the tar produced in gas-works, and that its extensive consumption for carburetting would cause a considerable rise in price. But a further source of benzol is found in the condensation products thrown down in the compression of oil gas used for railway carriage lighting by the Pintsch system. These products are very similar to those obtained at low temperatures

from ordinary coal gas. The oils distilled from these products had the following mean composition: 70 per cent. of benzene, 15 per cent. of toluene, 5 per cent. of higher homologues, and 10 per cent. of homologues of ethylene (estimated by bromine). But this source might also prove inadequate if benzol were considerably applied for carburetting. Large quantities, however, obtained from the gases produced in coke-ovens, by scrubbing prior to burning under the latter, have been put upon the market. But whether or not supplies from this quarter can be relied upon to provide the gas industry permanently with a cheap carburetting agent, must be a deferred question for the present.

From the foregoing, it must be evident that the gas industry possesses an extensive choice of enriching agents, and the power to moderate the heat developed by the burners. By judicious selection, and a rational application of the existing means of carburetting, suppliers of gas will succeed in economically meeting all demands made upon them.

EXPLOSIONS IN COAL MINES.

The above subject was under discussion in the Chemical Section of the British Association, at the recent meeting at Nottingham. It was introduced by Mr. HAROLD B. DIXON, M.A., F.R.S., Professor of Chemistry and Metallurgy in Owens College, Manchester; and contributed to by Dr. FRANK CLOWES, who holds the professorship for these subjects in the Nottingham University College, and who read a paper on the application of a hydrogen flame, burning in an ordinary miner's safety-lamp, to accurate and delicate gas testing.

Professor Dixon commenced by stating that explosions in mines were attributed to two substances—fire-damp and coal dust. That mixtures of fire damp and air could produce disastrous explosions was known; and several investigations had been made on the rate of transmission of the explosion and on other points. Many held that mixtures of coal dust and air were explosive, and a source of great danger. Others, however, contended that, while such a mixture was inflammable, it was not explosive, and the flame died out after travelling a short distance. Another view was that if air containing fire-damp, in quantity even too small to be detected by the ordinary method, should in any way become mixed with fine coal dust, the mixture was highly explosive and dangerous. Referring to the history of the subject, Professor Dixon pointed out that Faraday and Lyell first recognized that dust might be a fuel. As early as 1864, it was held that coal dust might be a source of explosion if set on fire by an explosion of fire-damp; and from 1870 to 1875 many small explosions took place in France which were attributed to the explosive properties of dust alone. Vital showed that a blown-out shot might raise a cloud of coal dust, and that, if this dust was very dry and fine, it would explode; the violence being greatly increased by the presence of fire-damp. Galloway, in 1876, made experiments which led to the conclusion that coal dust mixed with air was not inflammable *per se*, but became explosive when mixed with 1 per cent. of fire-damp. Later experiments, however, led him to the conclusion that certain kinds of coal dust were explosive when mixed with air alone. Reference was made to the experiments of Sir F. Abel, which seemed to show that a mixture of fire-damp and air was inflammable in presence of non-combustible dusts, such as fine sand. In the year 1882, the Chesterfield Committee came to the conclusion that, although mixtures of coal dust with air alone were inflammable, there was little or no concussion, and the flame did not travel any great distance. The combustion of the coal dust alone was never of an explosive character; but its presence was capable of greatly increasing the explosibility of small quantities of fire-damp. The Prussian Fire-Damp Commission of 1887 practically confirmed Galloway's results, and also found that the use of what are called high explosives might give rise to dust explosions. These conclusions were disputed by a French Commission; and MM. Mallard and Le Chatelier contended that dust and air, though inflammable, were not explosive, and did not become explosive unless mixed with more than 5 per cent. of fire-damp. These results did not accord with those of other observers. An Austrian Commission in 1889 came to the same conclusions as Galloway and the Prussian Commission; but they pointed out that different coal dusts differed greatly in inflammability, and that attention should be given to the nature of the explosives used for blasting, and especially to the character of the fuse. The statement that explosives did not travel through damp parts of a mine was confirmed; and it was recommended that explosives should be localized and isolated by always keeping certain sections of the mine damp. Recent experiments by Mr. Hall showed that different coal dusts varied enormously in their degree of inflammability; and that mixtures of some dusts with air were violently explosive if ignited by means of a large flame, such as that produced by a blown-out shot, or by a small explosion of fire-damp. The great variation in the properties of coal dusts probably accounted for the discrepancies in the reports from different districts. Whether or not it was true that coal dust and air alone were explosive, or that the presence of small quantities of fire-damp was essential, must be shown by further investigations on the nature of the dust from different mines, the methods of detecting very small quantities of fire-damp, the degree of danger attaching to the use of different explosives, and the efficiency of various methods of laying the dust in mines by water-spray, &c. If coal dust *per se* was in some cases explosive, a spray driven in by compressed air might render a mine safe.

At the close of Professor Dixon's remarks, Professor Clowes gave a demonstration of his method of indicating very small quantities of fire-damp in the air by means of his safety-lamp.* He said that the "flame cap" or halo seen in the dark above a pale flame in air containing combustible gas served as the most rapid and practical means of detecting the presence of inflammable gas or vapour. This method had been in common use by the miner; but the oil-flame, which he used for the purpose, was wanting, not only in delicacy, but also in accuracy. It would not readily detect the presence of less than 3 per cent. of fire-damp in the air; whereas for modern purposes it should detect less than 0·5 per cent. Owing to the variation in the size and adjustment of this flame when applied to testing, its indications were very variable, and were not of a standard character. Many objections existed to the employment of a separate alcohol lamp carried for testing purposes. None of these applied to the use of the hydrogen flame, especially when it was applied in an ordinary safety-lamp, burning oil from a wick in the usual way. The hydrogen flame was the most delicate indicator known; and it was applicable always of uniform size—giving standard and invariable indications. His early work consisted in measuring with accuracy the height and noting the appearance of the flame cap over the standard 10 mm. hydrogen flame. The flame was exposed for this purpose to air containing known percentages of gas in the test chamber specially devised for the purpose. The statement previously made, that the hydrogen flame was the most delicate gas-testing flame known, was fully confirmed by comparing its indications with those yielded by an alcohol-flame and by a reduced oil-flame. The author then directed his attention to applying the hydrogen flame in a practical way to the detection and measurement of minute quantities of fire-damp in the air. This was ultimately effected by supplying the hydrogen from a small steel cylinder containing the gas in a compressed condition. The cylinder could be readily carried in the pocket; and, when necessary, it could be immediately attached to the ordinary safety-lamp, and made to furnish the standard hydrogen flame burning at a jet in the lamp. The gas was kindled at the jet by the oil-flame, which was then extinguished. The accurate estimation of proportions of fire-damp in air varying from 0·2 up to 3 per cent. was rapidly and easily effected by the standard hydrogen flame. Higher percentages were estimated either by reducing the size of the flame, or by employing the oil-flame diminished in size until it became non-luminous. The small pocket cylinder was less than 1 lb. in weight; and when freshly charged, by being connected with a store cylinder at a pressure of 120 atmospheres, it carried a store of gas sufficing for upwards of a hundred tests. This combined lighting and testing safety-lamp had been found to be thoroughly practical in its nature after lengthened use in several collieries; and it surpassed in convenience all the delicate and accurate mine gas-testing apparatus yet described. The lamp, in a modified form, had been adapted to detecting and measuring petroleum vapour in the air.

In the discussion which followed, the President of the Section (Professor Emerson Reynolds) said he considered Professor Clowes's paper was an excellent illustration of the combination of science with practice, and of the value to an industrial district of the presence of an institution like the Nottingham University College. Professor W. Galloway pointed out that all mines of a greater depth than 600 feet are dry and dusty because of the increase in temperature at these depths, and the consequent increase in the capacity of air to absorb moisture. All mines less than 600 feet deep were damp; and no great explosion had ever occurred in such mines. All the most disastrous explosions, extending along great distances, and including all the ramifications of the mine, had taken place in dry and dusty mines. He thought MM. Mallard and Le Chatelier had been led to false conclusions by applying to the case of mines the results of experiments made in narrow tubes. He argued that mixtures of coal dust and air alone might give rise to violent explosions. He admitted that coal dusts varied in composition; but he said that many kinds of dust which had failed to produce explosions on the surface in experiments would be found to determine them in deep mines. The dust theory, as it is called, would alone explain many explosions. In Wales, although at first a great cry was raised against watering mines, spraying had been gradually extending; and many mining engineers testified to the improvement in the sanitary condition of mines in which a fair trial of this treatment had been given. Mr. Hall pointed out that an escape of gas could not possibly account for numbers of explosions which had taken place, and that, therefore, some coal dust theory would probably eventually be universally accepted. Dry coal dust, even in the absence of fire-damp, was certainly capable of causing an explosion; and he had actually produced one which travelled upwards of 200 yards by coal dust alone. The purity of the dust had a good deal to

* This appliance was briefly described in the "Register of Patents" in the JOURNAL for March 28 last.

do with determining its inflammability. As coal dust itself did not contain sufficient oxygen for its complete combustion, it was not an explosive in the strict sense of the term; but as, when in suspension, it was enveloped in a large quantity of air, the conditions approached very closely to that of a true explosion. Professor Thorpe said he was a firm believer in the dust theory; and he was certain that coal dust would explode without fire-damp. In his opinion, the Seaham Colliery disaster was conclusive that shot firing determined an explosion of coal dust. Professor Merivale agreed with Professor Thorpe that the dust theory explained most explosions; but he said that in the Seaham case it was the opinion of local men that there was no coal dust in the neighbourhood of the origin of the explosion. The cause of this disaster, therefore, was not easily explained. Mr. Stokes was of opinion that, unless a very large quantity of coal dust were present in the air, admixture with gas would be necessary to determine explosions; and he cited a case of an outburst of 8,000,000 cubic feet of gas in a dusty mine in which no gas had been noticed for four years, and in which, if an explosion had taken place, undoubtedly a coal-dust explanation would have been given. He did not believe that watering a mine was likely to be efficacious in preventing explosions, although he advocated this practice on hygienic grounds. Professor Lupton expressed the opinion that coal dust *per se*, if sufficiently fine, was dangerous. Mr. Ashworth, referring to safety-lamps, urged that legislation was required dealing with percentages of gas in mines, since, so long as the Act simply mentioned a blue cap, lamps would be used which were not the most accurate. Professor Dixon added a few remarks, and the discussion closed.

Incorporated Association of Municipal and County Engineers.—A district meeting of this Association was recently held at Leicester, under the presidency of Mr. J. T. Eayrs, of West Bromwich. The business was to inspect the extensive engineering operations lately undertaken by the Corporation, and nearly completed, in connection with works for the prevention of flood, and a system of main sewerage. Special interest was taken in the storm outfall culverts, which take off the surface waters in heavy rains, and leave the sewers free. These works are of a capacity to discharge 64 million gallons per 24 hours. The visitors also went over the sewage farm of 1700 acres. A paper was read by Mr. E. G. Mawbey, the Borough Engineer, and a discussion ensued. The works visited have all been put in hand within the last few years, at a cost of about £300,000.

Gas-Engines for Driving Electric Lighting Machinery.—A gas-engine has been in use for more than a year driving a dynamo at the station of the Waukesha (Ill.) Electric Light Company. It is a 100-horse power two-cylinder "Otto" engine, with an electric igniter and an unusually heavy fly-wheel and pulley; the regularity of motion being increased by the use of a heavy balance-wheel. Measurements of the consumption of gas have been made several times by the Manager (Mr. G. A. Farwell), who reports that in a 10-hour run, driving 53 arc lights of 2000-candle power on a 9½-mile circuit, 10,920 cubic feet of gas were burned; being equal to 20·6 cubic feet of gas per lamp per hour. In another test, 36 arc lights and 300 incandescent lamps were run on 1400 cubic feet an hour; and in still another test, 36 arc lights and 425 incandescent lamps were run on 1600 cubic feet an hour.

Covering for Steam-Pipes.—According to the *Annales des Mines*, the pipes supplying steam to the underground machinery in the collieries of Valdonne, in Provence, are protected by a covering which reduces the quantity of the condensed steam to 17 per cent. The pipes are surrounded first with rings of willow or chestnut wood, upon which laths are nailed closely. This is wound round with straw plaits 1 inch thick, upon which straw is laid lengthwise ⅔ inch thick; the whole being surrounded by old sail-cloth, previously tarred. According to Chrétien, the best steam-pipe covering is obtained as follows: The pipes are enveloped with three or four layers of strong tarred paper, which, well pasted together, is almost incombustible, and very durable. Over this are wound three layers of plaited rushes, and, finally, three more layers of tarred paper. The covering is 1·37 inches thick; and, when dry, it offers great resistance.

The Temperature and Luminosity of Gases.—At the recent meeting of the British Association, Professor Smithells read, in the Chemical Section, a note on the above subject. He said that, if a gas cannot be rendered incandescent by the temperature of a flame, the luminosity must be due to some other cause. The temperature is not definite, as all measuring instruments only give an average; but, from thermo-chemical data, it can be arrived at theoretically. These temperatures, however, are much higher than those of the dissociation point of the compounds produced. At certain points in the flame, high temperature must undoubtedly exist; and in the case of hydrogen, it amounts to 6655° C. Wedgwood found that air was not incandescent, even when it was so hot as to make a piece of metal glow in it. Hittorf arrived at a similar conclusion, and stated that the luminosity of a flame was of the nature of phosphorescence. Siemens found that the common gases at 1500° C. do not show any luminosity. Iodine when heated, however, gives a distinct flame or luminosity, as proved by Salet. The luminosity of flame is, therefore, probably simply an effect of heat.

REGISTER OF PATENTS.

Gas or Vapour Heating-Burner.—House, H. A., of Teddington, and Symon, R. T., of Abchurch Lane, E.C. No. 16,911; Sept. 22, 1892.

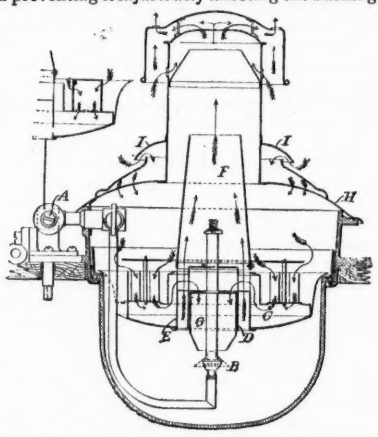
This invention relates to burners for the combustion of gas or vapours for heating purposes—as, for example, in steam-boilers for raising steam, or in generators for the production of gas or vapour from hydrocarbons or other liquids, for use in motive-power engines or for heating purposes. The object of the invention is to produce a burner which can be automatically regulated to suit the purpose for which it is to be used.

A hollow ring of cast iron is provided, with an inlet for the gas or vapour, and a turned or planed surface on its upper side, pierced with holes of suitable size spaced at equal distances apart. Each of these holes is provided with a faced block of metal, forming a small slide-valve, and capable, when slid over its corresponding hole, of preventing the escape of gas or vapour. These slide-valves are operated by a kind of frame or star-wheel, turning on an axis in the centre of the ring; and the valves are so placed with reference to the holes that each successive valve requires to be moved further than the preceding one in order to uncover its hole. Thus, assuming the frame with its slide to be in the position in which all the holes are covered by their respective slide-valves, on moving the frame and valves so as to uncover the first hole, the jet of gas that will issue from it may be lighted. On moving the frame and valves another step, the second hole will be uncovered; and the jet of gas or vapour issuing from it will be lit from the first jet. On moving the frame and valves another step, the third hole will be uncovered, and gas lit from the second jet, and so on. In like manner, on turning the frame and valves in the opposite direction, each of the holes will be covered in succession by its appropriate slide, and the gas-jets will be successively extinguished, in the reverse order to that in which they were lit.

When the burner is applied to a steam-boiler or a generator of hydrocarbon vapour, the frame and valves may be turned so as to bring into operation more jets, or cut them off, according as the pressure of steam or vapour falls or rises, by means of an automatic apparatus consisting of a diaphragm or piston, acted on by the pressure of the steam or vapour generated in the apparatus to which the burner is applied as a means of heating.

Regenerative Lamps.—Thomas, T. C. J., of Finsbury Park, London. No. 17,110; Sept. 24, 1892.

This invention has reference to a wind-proof regenerative lamp, in which the gas is supplied through a pipe arranged externally to the air regenerator, and provided with a burner fixed at a point below the air regenerator. The regenerator receives its supply of air from a chamber, the lower side of which is arranged to form a reflector, while the upper side is provided with air-inlets, so arranged as to break up and reduce the velocity of air passing through them to the flame, and thereby aid in preventing it injuriously affecting the burning of the lamp.



The engraving shows a vertical section of such a lamp constructed specially for use in a railway carriage; the ordinary bowl and jointed gas-supply pipe being retained.

The gas-supply pipe is jointed at A, so as to enable it to be turned either into position for use within the glass or back out of the way when it is required to clean the bowl. The lamp-casing is screwed to the outer side of the carriage roof, and provided at its under part with an inwardly extending flange, upon which the rim of the bowl rests. B is the burner, which is provided with a circular row of outlet apertures, so as to give a round flame. Above it is arranged a combined air regenerator and air-supply chamber C, from which it receives its supply of air. D E are two concentric tubes. The inner one (closed at its upper part) forms the air regenerator proper, and is in connection with the air-supply chamber C (which is upwardly extended as shown) by cross tubes. The outer tube E is at its upper part connected to chimney F.

In order to ensure a uniform distance between the air-outlet of the regenerator and the gas-outlet of the burner, so as to enable a combined air regenerator, air-supply chamber, reflector, and chimney to be used with lamp-bowls having different thicknesses of rim, and with hinged gas-supply pipes of varying lengths, the air-inlet is formed at the bottom of a tube G, adapted to fit into, and be capable of endwise movement within, the tube D. The tube G, which is contracted at its outlet end, is connected by a perforated plate with a central stem, the recessed lower end of which rests upon an upwardly extending part of the burner. The central stem is carried up through a hole formed in the closed end of the tube E; and the stem is provided at its upper end with a nut, which prevents it, and the parts attached to it, becoming disconnected when the chimney and attached parts are removed. The under side of the air-supply chamber C is formed as a reflector; and

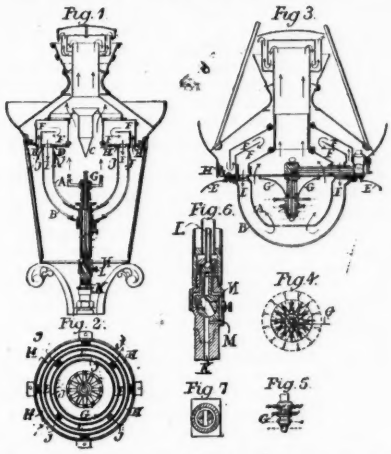
the upper side is provided with air-inlets, in the form of upwardly projecting tubes A, either cylindrical (as shown) or conical.

Instead of the air-inlets to the supply chamber being in the form of tubes, the top of the air-supply chamber may (as shown at the top left corner) be formed with a number of holes, so arranged that the edges of the holes extend upwards, above them being arranged an annular chamber, with a closed top and with perforated sides. The air current is, by these means, broken up, and its velocity reduced, during its passage to the flame.

The removable combined air regenerator and air-supply chamber, with the reflector and chimney above described, are supported by a flared lip formed at the upper edge of the chamber C, which rests upon the ring, as shown; part thereof being cut away to accommodate the gas-supply pipe. The lamp-casing carries a lamp head or cover H, which is hinged thereto and provided with air-inlet passages, and with baffle-plates I, which assist in ensuring a steady flow of air to the regenerator.

Gas-Lamps.—Mantrant, U., of Paris. No. 20,053; Nov. 7, 1892.

This invention in gas-lamps, designed for recovering part of the heat of the flame, is characterized essentially by the horizontal or nearly horizontal arrangement of the recuperating chamber, by the combination of two concentric bell-shaped glasses, between which the hot air descends for feeding the burner directly below the flame, and also by the cock which controls the supply of gas to the burner.



Figs. 1 and 2 are a vertical and horizontal section of a lamp to be carried by a column. Fig. 3 is a vertical section of a suspension lamp. Fig. 4 is a plan of the burner shown in fig. 3. Fig. 5 is a side view of the burner. Fig. 6 is a vertical section (enlarged) of the three-way cock shown in figs. 1 and 2. Fig. 7 is a horizontal section of the cock.

In both modifications, the burner is arranged in the interior of a bell-shaped glass or globe A, having a similarly shaped globe B arranged on the outside, with a passage for the air coming from the recuperating chamber. An aperture is provided in the lower part of the interior globe, which allows the air to pass in directly below the flame. Above the burner is arranged a central deflector C, made conical as shown in fig. 1, or parabolic as shown in fig. 3. A second deflector is arranged at D (fig. 1) in the interior of the lamp; and in the other modification is arranged a deflector E on the outside of the lamp, as in fig. 3.

The recuperator consists either of a horizontal chamber F (fig. 1), or the chamber may be inclined as in fig. 3. Each enclose a disc, above and below which the heated air circulates. The sides and the disc are heated by conduction through the crown forming the base of the chimney, which is strongly heated by the products of combustion.

The cold air from the outside passes through a series of apertures H at the bottom of the recuperating chamber F into the latter, round the disc, and through a second series of apertures in the bottom between the globes A B, and then through the apertures at the lower end of the interior globe below the burner; while the hot products of combustion rise between the deflector C and the crown and pass through the chimney, which is protected by a cap against the wind.

In fig. 2 is shown how the plate which forms the bottom of the recuperating chamber is constructed. H are the apertures for the inlet of the cold air; and I are other apertures for the outlet of the hot air. J are circular grooves designed to receive packing material, so as to form an air-tight joint between the glasses and the bottom of the recuperator.

The arrangement of the burner G may be varied; the jets being either arranged vertically as in fig. 1, or horizontally as in fig. 3. In the latter case, the jets are arranged in several superposed series, so as to form a kind of stepped burner having a conical surface. A "more beautiful effect is obtained by distributing the jets, so that the flames of a series encounter each other, and that the jets of two superposed series have a lozenge-like arrangement." Moreover, a prettier effect is obtained (a group of fuller flames) by arranging the butterfly jets obliquely, as in fig. 5.

The cock which serves to control the supply to the burner is arranged either vertically or horizontally; but the interior construction remains the same. It comprises a box M, in which the plug N turns. The gas enters at K; and, before reaching the plug, it passes through a small independent conduit, which supplies a little gas to the central jet and enables it to burn as a night light—a screw serving to regulate the passage of gas through this conduit. The box M is provided with two conduits, one of which also supplies the central jet with enough gas for maintaining a small night light, while the other has a transverse branch L terminating in the annular chamber which supplies the exterior or radiating jets of the burner. The plug N of the cock has two passages corresponding to the two passages in the box.

Gas-Engines.—Pinkney, C. W., of Smethwick, near Birmingham. No. 20,683; Nov. 15, 1892.

This invention relates to gas-engines which work on the "Otto cycle;" and the object aimed at is to simplify the engine by reducing the number of working parts, by dispensing with the ordinary gearing-wheels, side-shaft, brackets, valve-levers, and the like.

The pressure of the charge of gas and air when being compressed, and of the explosion of the charge, is caused to bring into, and maintain in position for the requisite time, a connection of, or attachment to, the exhaust-valve; so that an attachment of, or part operated by, the crank-shaft operates thereon when the exhaust-valve is to be opened—remaining closed at other times, as the attachments of the valve and crank-shaft respectively are then not in position to act to open the exhaust-valve.

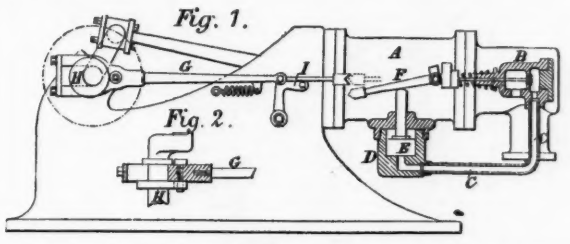


Fig. 1 is a horizontal section of so much of a gas-engine as is necessary to explain the application of the invention. Fig. 2 shows in plan a part of the crank-shaft, and of the attachment which operates the exhaust-valve.

The exhaust-valve box B, into which the gases pass from the working cylinder A of the engine, before they pass through the exhaust-valve to the outlet, has a passage therefrom, which leads, by the pipe C, into a cylinder or vessel D, in which moves a piston E, having attached to it a rod, which, when the piston is in its elevated position, brings a lever F on the end of the exhaust-valve spindle into line with the rod G. This rod has a jointed end portion, with a mouth-shaped termination, thrust rearward by the crank-shaft. This is shown as being effected by a cam on the crank-shaft H, acting on a roller on the rod G, the crank-shaft end of which is bifurcated so as to embrace the shaft H between the cam and collar, which act as a support and guides therefor. The other end of the rod G is supported by a lever centred to the engine-framing; and there is a spring which returns the rod G and its attachments after the cam has acted upon it. When the engine is at work, as the piston in the main cylinder makes its charging stroke, the vacuum formed in the cylinder will, by the communication of the exhaust-box B by the pipe C with the cylinder or vessel D, draw the piston E down or inwards, so that the lever F is not in line with the rod I. When the piston in the main cylinder returns and makes its compression stroke, the pressure of the charge will cause the piston E to rise or move outwards, so that the lever F will be brought into line with this rod (as indicated by the dotted lines); the lever F having a bearing-piece to take the strain. At the end of the compression stroke, the explosion of the working charge of the cylinder A takes place; the pressure still keeping the piston E in its last-named position. When the crank of the engine has arrived at the position at which the exhaust-valve should be opened, the rod G is moved by the cam, so that the mouth at the end of the rod I meets and acts upon the end of the lever F, which is now in its path (as shown by the dotted lines); and the exhaust-valve is opened until the main piston has reached the end of its exhausting stroke, when the exhaust-valve closes, and is held tightly to its seat by its spring. The piston in the main cylinder A now commences to make its charging stroke. A vacuum will again be formed in the main cylinder; and the piston E will take such a position that the lever F is out of line with the rod I (as shown in full lines). Therefore, although this portion of the revolution of the crank-shaft corresponds with its position on the occurrence of the explosion, the exhaust-valve will not be opened, as the end of the rod I will not abut against the lever F.

Driving Stoking Machinery for Gas-Retorts.—Woodward, J., of Manchester. No. 21,395; Nov. 24, 1892.

This invention refers to mechanism for actuating coal breakers, elevators, and charging and raking mechanism used for supplying coal to, and removing coke from, gas-retorts. The charging and raking machines are upon carriages, arranged to run upon lines of railway extending the lengthway of the retort-house, and parallel to the mouths of the retorts, the lengthway of which are at right angles to the railways for the charging and raking machines. The motor for driving the mechanism is at one end, and at about the middle, of the retort-house—using a gas, steam, or other motive engine.

In the illustrations [next page], A is the fly-wheel shaft of the motor, with a pulley upon it; and endless ropes run from this to one B on a counter-shaft. This latter pulley drives by a belt or ropes, a pulley on a horizontal shaft C, extending from end to end of the retort-house. This shaft C rotates in bearings on suitable supports from the wall, at intervals of (say) about 6 feet apart. A corresponding horizontal line shaft is placed on the other side of the house, to drive the machinery for the retorts on that side.

The shafts may be driven by toothed gearing and shafting, if desired, or each shaft may be connected directly with the first-motion shaft of the motor employed. Each shaft has drums keyed upon it—at (say) 3 feet apart; and these drums are to a short extent rounded, or inclined in cone-form, at the corners, for a purpose hereafter named. In about the middle of the length of the retort-house, there may be any ordinary machine for breaking up coal, and delivering it to the scoops or buckets of an endless-chain elevator in an inclined position (partly shown in figs. 1 and 3).

The shaft D for the upper end of the elevator rotates in bearings carried on the framing E, connected with a hopper coal-bunker F, which

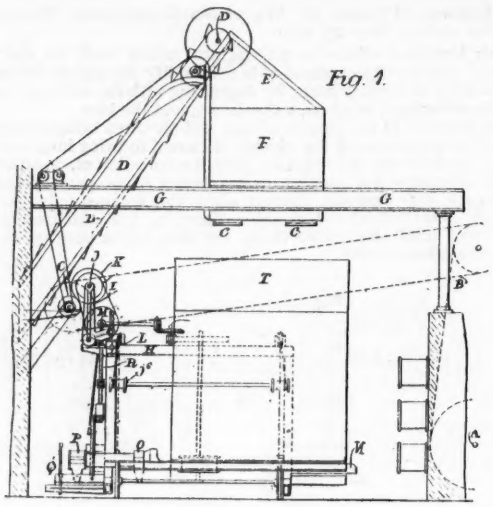


Fig. 1.

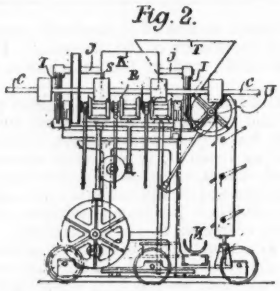


Fig. 2.

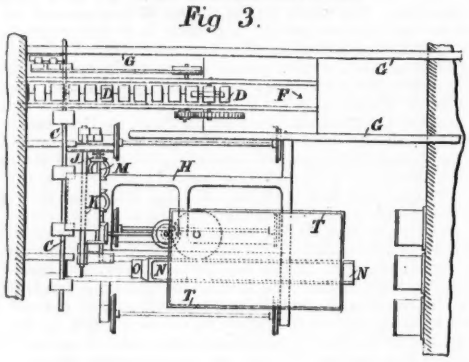


Fig 3.

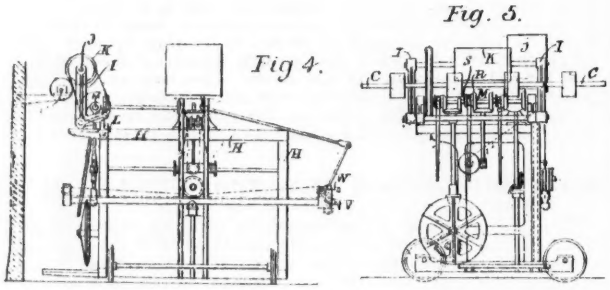


Fig. 5.

Fig 4.

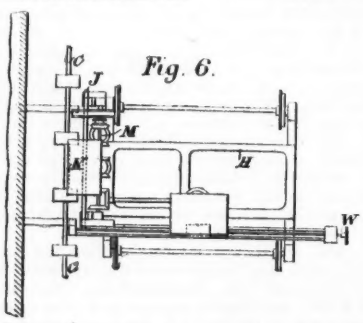


Fig. 6.

is carried on beams G, supported at one end on the walls of the house, and at the other end on columns. The end of the shaft D for the upper end of the elevator has a spur-wheel upon it that gears with a spur-pinion on one end of a shaft, in suitable bearings carried by the framing E; the other end of the shaft having fast-and-loose pulleys upon it for an endless belt, which passes over guide-pulleys, rotating on studs in a bracket secured to one of the beams G, and then works upon a pulley on the shaft C, of about the same size as that for the coal-breaker.

There are two slides on the under side of the hopper-bunker F, which are opened and closed by connecting rods and levers, or other suitable mechanism (not shown); so that, when the charging-machine is brought under the hopper-bunker, the coal from it may be allowed to fall through the holes covered and uncovered by sliding doors into the hopper of the charger, hereafter further referred to.

On the upper framing H of the charging-machine, there are bearings for an oscillating shaft; and at or near each end of this shaft an arm I is secured, the upper ends of which form the bearings for a rotary shaft J. On this shaft there is a drum K, long enough, at least, to extend from the middle of one drum to the middle of another one on the shaft C. Each end of this long drum is coned for a short length, so as to easily pass from one drum to another, in either direction, when the carriage of the charging-machine is moved along the rails. At one end of the shaft, there is an arm, to the end of which a screw-shaft is jointed, so as to pass freely through holes in two arms of a bracket secured to the framing—one arm of the bracket above, the other below a hand-wheel L, the hole in the boss of which is screw-tapped. A helical spring is placed between the boss of this wheel and the arm of the bracket—both above and below the boss of the hand-wheel—so that the pressure in either direction, caused by the hand-wheel, will be elastic; and when the wheel is screwed downwards, the periphery of the drum K will be pressed against the peripheries of one or two of the drums. When the screw hand-wheel is rotated the reverse way (that is, to screw it upwards), the long drum K is withdrawn from contact with the drums.

There is a pulley on the shaft J, which by a belt drives a pulley fast on the shaft M, in suitable bearings, on the framing of the charging-machine. This shaft may be driven from the shaft J by a spur-wheel, smaller than the long drum K in diameter, gearing with a spur-wheel on the shaft M, or gearing first with an intermediate spur-wheel and then with a spur-wheel on the shaft.

N is the scoop which carries the charge of coal into the retorts. At the outer end it is attached to a shaft or barrel, which is in two bearings, one on each of two separate carriages O P, which have axles and wheels that run in a channel-iron frame lengthway of the scoop. The inner-carriage O bearing for the scoop stops at the end of the channel-iron framing, when the scoop is pushed into the retort; and then the barrel or shaft of the scoop with the outer carriage P can move forward until it comes against the inner-carriage bearing O. The scoop is supported upon a horn plate, over which it slides, at the inner end of the channel-iron framing nearest the retorts.

The scoop, and the framing upon which it is carried, have to be raised and lowered between and against suitable vertical guides upon the framing H, to bring the scoop opposite to the mouth of the retort to be charged; and the scoop has also to be moved into and out of the retort, and to be turned half round to discharge its contents when within the retort, and to be turned back in the reverse direction when withdrawn from the retort, so as to be ready to receive the charge of coal. The scoop is worked in and out of the retort by a chain attached to the shaft and barrel of the scoop.

Q is a lever on the end of a square shaft, connected with a lever or ratchet catch on the framing of the carriage-scoop. The catch enters a notch in the barrel, and prevents it from partly rotating until the catch is released by the handle, when the strain on the chain drawing the scoop in or out, as the case may be, causes the barrel, and thus the scoop, to make a half rotation. There is also a pair of bevel friction-wheels R on the shaft M, moved to and fro endways by means of a lever-handle, in a similar manner to the bevel friction-wheels for actuating the drum on the vertical shaft. These bevel friction-wheels drive a bevel friction-wheel on the upper end of a vertical shaft J (see fig. 2), in suitable bearings on the framing, the lower end of which shaft has a worm upon it gearing with a worm-wheel on one end of a horizontal shaft in suitable bearings on the framing. There is a similar pair of bevel-wheels S to those above described on the shaft M (with a lever for moving them), which will drive a bevel friction-wheel at the upper end of a vertical shaft in suitable bearings on the framing. The lower end of this shaft has a bevel toothed pinion upon it, which gears with a toothed bevel-wheel on a stud in a bracket from the framing H, which has a spur toothed wheel attached to its boss that gears, by an intermediate spur-wheel on a stud in the framing, with a spur-wheel on one of the axles having carrying wheels upon them, that run upon the railway. By this gearing, the charging-machine is moved to and fro along the railway, and also brought opposite to the retort to be charged.

The hopper T on the charging-machine is large enough to hold sufficient coal or cannel for a number of retorts. At its lower part, there is a shaft U, extending from end to end of the hopper in suitable bearings; and this shaft has arms or vanes upon it, which, when the shaft is rotated, will cause the coal from the hopper to be discharged into the upper end of a narrow vertical shoot the length of the scoop N. This vertical shoot has shafts extending its lengthway in suitable bearings on the ends of the shoot; and each shaft has a directing blade, which in one position closes the shoot below it, and forms an inclined bottom or director, causing the coal descending into the shoot to pass out at a hole in the side of the shoot, and into the scoop previously brought into the position to receive the coal.

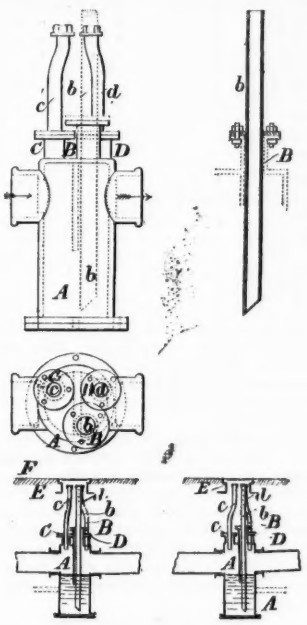
The mechanism of the raking-machine is similar to that for the charging-machine—that is to say, rotary motion is conveyed from the shaft C to a counter-shaft M, and, by similar arrangements of gearing, from that shaft to work the machine to and fro on the railway. The mechanism for raising and lowering the rake-frame is similar to that for raising and lowering the scoop-frame, except that there is one long drum in about the middle of the horizontal shaft, and two chains from it, passing over two guide-pulleys, are then connected near its centre with the frame for the rake, which is made capable of oscillation on a fulcrum at the middle of its length; so that, when the rake end ascends, the other end descends, and *vice versâ*. When the rake V is drawn back to the position shown in fig. 4, its rake end is under a T-pipe W (see figs. 4 and 6); the head of the T-pipe being perforated on its lower side to discharge downwards on the rake rod and head, and the

pipe is connected by a jointed pipe (which allows the rake-frame to ascend and descend) with a cistern filled with water, when the raking-machine comes under or about the position of the coal-bunker, by a pipe from the water-main. This water-pipe arrangement is for cooling the rake when drawn out of the retort after each operation.

The same letters of reference are used on figs. 4, 5, and 6 as on figs. 1, 2, and 3 for corresponding parts having similar functions in both charging and raking machines. Such parts will, therefore, be understood from the previous description of the charging mechanism.

Syphon Test-Boxes for Gas-Mains.—Bouvier, A., of Lyons, France. No. 15,446; Aug. 14, 1893.

As shown in the engraving, the patentee proposes to employ a water-tight receiver or metal box A (usually of cast iron), two opposite sides of which are provided with sockets for connecting to the gas-main. The inner chamber of the syphon test-box is divided only in the upper portion by a central vertical partition of cast iron, which does not reach the bottom. The gas on entering passes freely under the partition, and then out of the syphon, unless the test-box be filled with water to a height sufficient to cover the bottom of the partition.



In this case the passage of the gas is stopped; and the box plays the part of a gas-cock or hydraulic sluice-valve—allowing the several parts of the main to be isolated. Upon the dome or cover of the syphon test-box are three flanged cast-iron sockets B C D, each provided with a pipe marked with the corresponding letter *b c d*. The socket B receives the iron pipe *b*, bevelled at its lower end, and dipping down to the bottom of the syphon. This dip-pipe allows the quantity of water necessary to prevent the passage of the gas to be introduced into the test-box; and it is also used for removing the water contained in the syphon, by means of a hand-pump. The two sockets C and D—which are arranged one to the right and the other to the left of the central partition—serve for the passage of the gas for testing the tightness of the main.

The syphon test-box above described serves as an ordinary syphon trap to receive the water of condensation of the gas. It also serves as a junction-piece for the mains, and as a hydraulic sluice-valve, for preventing the passage of the gas at any time—for example, in case of a sudden accident, a fire or explosion, or when any repairs to the system, replacing pipes, &c., are taking place. It also facilitates the laying of new pipes, and is serviceable in detecting escapes of gas in the main. The test-boxes are arranged under suitable manholes E; the line F representing the ground level.

To employ the apparatus for the detection of leaks, the proceedings would be as follows: A given section of the main, comprising a portion of a street or even several adjoining streets in the same quarter, having been isolated from the rest of the main, by means of one or several syphon test-boxes previously filled with water, a portable gas-holder (mounted on wheels) would be brought to the spot. Suppose that the inlet-tube, and consequently also the tube C, communicates with the side to which the gas comes freely from the gas-works under the usual day pressure of the gas, and that the outlet-tube, and consequently also the tube D, communicates with the isolated section, then all the branches fed by this section are closed—thus cutting off the gas from the houses in this section. The inlet-tube of the gasholder is then caused to communicate, by means of a rubber tube, with the pipe *c*. The bell of the holder rises, on account of its float; and is filled with gas at the existing pressure. When it is full, the inlet-pipe *c* is closed; and the outlet-tube of the holder is caused to communicate with the pipe *d* of the syphon test-box, and thus with the section to be tested. Sufficient weight is placed on the bell to give to the gas it contains a very high pressure. This gas is driven back under pressure into the isolated section; and if the section be leaky, the bell descends with a speed proportional to the size of the leaks. If a note be taken in each section of how much gas it loses per minute under the testing pressure, it is possible to thus know "the relative tightness of each section under conditions which augment the sensibility of the test and the precision of the measurement."

APPLICATIONS FOR LETTERS PATENT.

18,431.—Hughes, R. S., "Pendent gas-lights or gaseliers." Oct. 2.

18,554.—Barton, A. H., "A combined washer and grummet for use with water, steam, gas, air, or other fluids, and to prevent vibration between metal surfaces." Oct. 4.

18,574.—Banks, T., "Production of carburetted hydrogen for illuminating and other purposes." Oct. 4.

18,660.—Pass, E. De., "Illuminating and heating by means of petroleum." A communication from J. Leemann. Oct. 5.

18,662.—Bate, H., "Gaslight appliances." Oct. 5.

18,673.—Lister, A. A., and Dawson and Co., "Gas-retort self-sealing mouthpieces." Oct. 5.

Increase in the Price of Gas at Wolverhampton.—The Wolverhampton Gas Company have given notice to their consumers that, owing to inability to obtain coal, except at an advanced rate, they intend to raise the price of gas 3d. per 1000 cubic feet from Nov. 1.

The Middlesbrough Trades and Labour Council and the Corporation Gas Workers.—At the meeting of the Middlesbrough Trades and Labour Council last Wednesday, there was some reference to a "grievance" among the employees at the gas-works; but at present we have no information as to its nature. The Chairman (Mr. J. Smith), who is a member of the Town Council, moved a resolution requesting the Chairman of the Corporation Gas Committee (Alderman T. H. Bell) to call a special meeting of the Committee at a convenient date, when the matter might be fully discussed, and both sides of the question heard. He considered it would be foolish to withdraw the men before trying to get the grievance settled; but if Alderman Bell refused to comply with their request, he thought it would be advisable for the men to be withdrawn. The motion was carried.

Dispute Arising through a Faulty Gas-Meter.—At the Highgate Petty Sessions, on Monday last week, Mr. Valenzuela, of "Beaconsfield," East Finchley, was summoned by the North Middlesex Gas Company for £4 5s. 8d. for gas supplied and meter-rent due from him. The case had previously been before the Court, but had been adjourned to see if an arrangement could not be come to. The Company's collector (Mr. Gale) stated that up to the 18th ult., when the summons was issued, £6 14s. 4d. was owing, less a deposit of £2 and 2s. interest. Defendant complained that the meter was incorrect; and it was taken away and tested, and found to be 4·7 per cent. fast. For this the Company had allowed 6s. 8d.; and the balance was the amount claimed. After looking into the matter with respect to the ownership of the meter, they were willing to deduct £2 16s. for this; and they had offered to accept £1 9s. 8d. in settlement of the claim. During the time the Company had supplied the defendant, he had been summoned six times. Defendant said the Company admitted they were wrong; and he asked for costs. The Bench decided that the Company should have an order for £1 9s. 8d., and pay the defendant 21s. costs. The net result of the proceedings was that they obtained 8s. 8d., besides paying the Court fees.

Increase of Salaries in the Sheffield Corporation Water Department.—At last Wednesday's meeting of the Sheffield City Council, several members protested against a proposal of the Water Committee to increase the salaries of three of their officials—Messrs. J. and A. Roberts and J. Hawksley. It appears that Mr. W. Roberts, the reservoir inspector, who received £300 a year, has lately died. He had been in the service of the Water Company and the Corporation for 40 years; and, for some time prior to his death, he had been unable to thoroughly carry out his duties. The Committee, however, maintained him in his position; and his two sons substantially did his work. It was now proposed to promote them to those positions and salaries to which they had been entitled for several years; and, according to Alderman Gainsford, the saving effected by the re-arrangement will be between £110 and £160 per annum. Among the members who opposed the Committee's recommendations was Alderman Clegg, who considered the salaries in the Water Department were much higher than those paid in any other department of the Corporation, from its head downwards. He could not see that Mr. A. Roberts and Mr. Hawksley (who is an assistant in the Engineer's department) had had any further responsibilities placed on them; and he moved, as an amendment, that as much of the minutes as related to them be not confirmed. This, however, was defeated; and the Committee's proposals were carried.

Electric Lighting for Yeadon.—The ratepayers of Yeadon were called together yesterday week to consider the advisability or otherwise of adopting a system of electric lighting. In opening the proceedings, the Chairman of the Local Board (Mr. J. Flaxington) very fairly stated that the Gas Company had given them satisfaction both as to price and quality of the gas supplied; but, after investigating the matter, the Board had come to the conclusion that it would be to the interest of the ratepayers if they put down an electric-light installation. Messrs. Andrews and Preece, of Bradford, had submitted a scheme, and guaranteed that they could furnish the light—allowing for cost of labour, fuel, interest on capital, &c.—at 4d. per unit, which was equal to gas at 1s. 6d. or 1s. 7d. per 1000 cubic feet; whereas they were now really paying 2s. 11d. It was proposed to charge 10s. per lamp per annum for the electric light; and there would be no restriction as to the length of time it was used. Mr. Preece explained that they were able to supply the light at the price named through the fact that they employed gas-engines worked by Dowson gas, which reduced the expense of fuel to one-third the cost where steam-engines were used. At Morecambe, where their system had been in operation some time, the Company had, with a charge of 10s. per lamp per annum, been able to pay a dividend of 5 per cent. on the first year's working. It was also pointed out by Mr. Chippendale, a member of the Board, that the 107 public lamps at present cost for gas and wages £1 14s. 1½d. per annum; and the same number of electric lamps at 10s. each would mean a saving of £130 a year. After these eulogistic statements regarding the electric light, it is not surprising to learn that a resolution giving the Board power to carry out the scheme was passed with only three opponents.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Stopped Gas-Meters.

SIR,—One of the vexations of a gas company's secretary is the dealing with those instances where a dry meter has passed the usual supply of gas without registering any, or only a portion, of the quantity consumed. No dry meters, I believe, are free from this defect, though I admit the percentage of such occurrences is a small one. The common usage is to charge for a similar quantity of gas to that consumed in the corresponding quarter of the previous year. Where no exceptional difference in consumption has occurred, this arrangement is commonly found to be satisfactory to the consumer. In other cases, however, considerable friction arises; and, with some unreasonable people, subsequent explanation is difficult, and often not pleasantly accepted. It has occurred in some instances that *no gas* has been consumed, and the register by the meter is actually the truthful one. If, in such a case, the amount of a corresponding quarter happens to be charged, under the impression that the meter has stopped registering, and without the opportunity of obtaining the real facts, the chances are that a peppery and indignant consumer may rush into print with his supposed grievance, and prove, at least to his own satisfaction, "Another Attempt at Extortion by a Gas Company."

To meet the difficulty likely to arise, and, as far as possible, avoid giving dissatisfaction, I affix to the statement of the gas account presented one of the notices of which I enclose a copy. I find that this disarms criticism of the offensive kind. As the idea may be useful to other companies, perhaps you may deem this, and the form of notice sent, worthy of space in the JOURNAL.

A. W. MARKS,
Secretary, Sheppy Gas Company.

Sheerness-on-Sea, Oct. 13, 1893.

[ENCLOSURE.]

Stopped Gas-Meters.

Although dry gas-meters are found to register with great correctness, one defect some meters have is that they stop registering while passing the usual supply of gas. Unless the consumer is in the habit of reading the indication of his meter weekly or monthly, this defect is seldom detected by the company until the end of a quarter. When a meter is found to have stopped registering in this way, the account is made out for the same quantity as that which was consumed in the *corresponding quarter* of the previous year. This charge is, however, subject to correction, if, from circumstances which can be reasonably explained, the consumer is confident of having used a smaller quantity of gas. In any such case, a fair estimate of the quantity of gas consumed will be made.

Incoming Tenants' Liabilities for Gas.

SIR,—I have no doubt that many gas managers would be glad to have the following point authoritatively settled: At certain premises A was burning gas. Some time during the quarter, A disposed of the business to B; and this was not discovered until the bill was delivered at the premises. The account was made out in the name of A; and B declines to pay the whole amount. No notice was given of the transfer by either A or B. I may state that, in this instance, A has gone away without leaving any address. I hold that B is liable for a ll the gas consumed during the quarter, if not for arrears.

B.

Oct. 10, 1893.

Compensation for Meters, &c., Destroyed by Fire.—A correspondent asks any of our readers who can do so to be good enough to inform him if a gas company can legally recover the value of a hired gas-meter or appliance accidentally destroyed by fire on a consumer's premises.

A Correction.—At the close of the portion of last week's article on "Coal Gas" dealing with governors (p. 672, col. 1), it should have been stated that, in Sugg's, Borradaile's, and other governors, steatite *or metallic* floats are used. In the sentence as printed, the words italicized were inadvertently omitted. Mr. Borradaile, in calling our attention to this matter, writes: "My governors are made of hard metal; Mr. Sugg's steatite float having been brought out considerably later than my metallic float."

"Penny-in-the-Slot" Gas-Fires.—Writing on the above subject, Mr. E. W. T. Richmond points out that hot-air gas-fires—*i.e.*, gas-fires with a stove body, would readily commend themselves to hotel proprietors where gas does not exceed 3s. 6d. per 1000 cubic feet, if any suitable check could be provided against extravagance. The disadvantage of a bedroom coal-fire is that it must be attended to during the night, or re-lighted in the morning; and a "penny-in-the-slot" fire would be open to the same objection. A much simpler plan would, he says, be the adoption of a lock-tap similar to the one that was designed by the Dublin Gas Company for use with cookers. If this tap were unlocked for (say) two hours at night and an hour in the morning, the usual charge of 1s. for coal-fires would leave a handsome profit, besides giving the extra comfort of a fire to dress by. Different sizes of fires would, of course, be needed to suit the various sized rooms; but taking, as a very outside estimate, a consumption of 100 cubic feet for the three hours, the gas-fire would cost, with gas at 2s. 6d. per 1000 cubic feet, 3d., as compared with 1s. charged. A slightly higher charge might be made for cases where the fire was left on longer. Mr. Richmond adds: "If the result of your suggestion be only to awaken some few enterprising gas managers to get one or two hotel proprietors to hire (say) fires for six bedrooms, and have them put on a special meter for twelve months, the result will undoubtedly open a field of consumption well worth cultivating by gas companies."

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, Commercial, and South Metropolitan Companies, during the quarter ending the 30th ult.:—

1. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows:—

The Gaslight and Coke Company—	
Fenchurch Street, E.C.	16·5
Kinghorn Street, E.C.	16·7
Dorset Buildings, E.C.	16·6
Ladbroke Grove, W.	16·5
Devon's Road, E.	16·2
Carlyle Square, Chelsea, S.W.	16·1
Camden Street, N.W.	16·4
George Street, N.W.	16·1
Graham Road, E.	16·6
Kingsland Road, E.	16·4
Spring Gardens, S.W.	16·2
Grove Gardens, St. John's Wood, N.W.	16·2
Hornsey Road, N.	16·3
Lambeth Road, S.E.	16·3
Millbank Street, S.W.	16·7
Commercial Gas Company—	
Parnell Road, E.	16·2
Wellclose Square, E.	16·3
South Metropolitan Gas Company—	
Hill Street, S.E.	16·7
Bedford Road, S.W.	16·2
Stoney Lane, S.E.	16·6
Lewisham Road, S.E.	16·5
Blackfriars Road, S.E.	16·8
Burrage Road, S.E.	16·4

It will be seen from these results that the average illuminating power at all the testing-stations has been higher than the parliamentary standard of 16 candles. At the Dorset Buildings station of The Gaslight and Coke Company and the Hill Street station of the South Metropolitan Gas Company, the minimum lighting power of the gas was better than the requirements.

11. *As regards Purity.*—Sulphuretted hydrogen has not been present in the gas at any of the stations. The average amount of sulphur in other forms than this was considerably less than the quantity allowed at all the testing-stations of the three Companies. An excess of sulphur was reported to have been present in the gas tested at the Kingsland Road station on the 13th of July, and at the Hornsey Road station on the 15th of July. Ammonia has been generally present in the gas more or less frequently during the quarter at all the stations; but only in slight quantities. The amount permitted was, however, not exceeded on any occasion.

BELFAST CORPORATION GAS SUPPLY.

Annual Accounts.

The abstract of accounts of the Belfast Corporation Gas Department for the year ending June 30 were published last week. With regard to the capital account, the outlay during the past year was £26,156; among the items making up this amount being the following: New main and service pipes, £4982; retort-house, benches, settings, &c., £7162; stoking machinery and stage floor, £8919; carburettors, &c., £940; exhauster-house, £374; governor-house and fittings, £874; meter-shop extension, £1757; and oil-gas plant, £302. The revenue account shows that the sale of gas (after deducting discounts, £8819, and bad debts, £180) produced £114,139; and public lighting (after meeting the cost of lighting and repairing the lamps, £4487), £11,907. Coke and breeze (less labour, £4422) yielded £38,324; tar, £9693; and ammoniacal liquor, £7975. The rents received for stoves came to £1790; and, with two other small amounts, these various sums made a total revenue of £183,899. The following are the items on the debit side of the account: Coal, including all expenses, £88,128; purification and sundries, including labour, £3288; salaries of Engineer and assistant, £1355; carbonizing wages, £17,504; repairs and maintenance of works and plant, £10,118; coal and coke used for steam-boilers, £508; distribution of gas, £6624; rents, rates, and taxes, £4214; salaries of cashier, accountant, &c., £2163; salaries of collectors, £1207; stationery and printing, £267; general establishment charges and incidental expenses, £969; audit fund, £52; law charges, £31; and insurance of works, £157. The total expenditure was £136,537; so that there was a balance of £47,312 to be carried to the net revenue account.

THE PRICE OF GAS AT DUKINFIELD.

A recommendation of the Gas Committee that the price of gas should be advanced 1d. per 1000 cubic feet recently came before the Dukinfield Local Board; but, after some discussion, it was referred back to the Committee for further consideration. Mr. J. Pickup, the Chairman of the Gas Committee, suggested that this course should be pursued because the matter was "rushed through" at the last meeting of the Committee, when, out of the nine members composing the Committee, three voted for the increase, and two against, while the others were neutral. Mr. J. E. Lawton thought the matter ought to be disposed of at once. From figures which were laid before the Committee, it seemed that they were not paying their way; and this, together with the fact that they had to buy coal at

an enormous advance in price, justified them in raising the charge. Mr. J. Blocksage said he was opposed to the increase. The only reason advanced in its favour was that there was a deficit of £700; but this was explained by the fact that, during the recent prolonged strike in the cotton trade, the consumption of gas fell off, and the cost of manufacture proportionately rose. But they had since wiped off this loss by a cheaper purchase of coal, and by obtaining a better price for sulphate of ammonia. It was true that they were paying more for the coal which they had to purchase now; but, on the other hand, they were getting an advanced price for coke. Notwithstanding the deficiency last year, there would be a profit this one. Mr. W. E. Wood thought the question of the price could very well stand over until the end of the present financial year; and, the Chairman and other members concurring, the matter dropped with something like an understanding that nothing more would be heard of it for a few months.

The discussion produced the usual ill-informed newspaper criticism; the Gas Committee being informed that the price was already "heavy enough compared with neighbouring towns," and counselled to lessen the cost of production. Mr. Harrison Veevers, the Gas Engineer and Manager, has published an elaborate reply, in which he gives the price charged for gas at Dukinfield, Ashton-under-Lyne, Denton, Hyde, Mossley, Stalybridge, Congleton, Runcorn, Bolton, Preston, Chorley, Leigh, Rochdale, and Bacup. At Dukinfield, it is 2s. 6d. to 2s. 11d. per 1000 cubic feet; and Mr. Veevers says that the only neighbouring towns with a lower price are Ashton-under-Lyne (2s. 4d.) and Stalybridge (2s. 10d.). He points out that in Dukinfield meters are supplied rent free; and that this is equivalent to a reduction in the charge for gas. The actual income per 1000 feet of gas at Stalybridge for the year ending March 25, 1892, was 2s. 9·01d.; and at Dukinfield, 2s. 9·02d. As to the cost of production, he gives the following figures as covering the cost of manufacturing, distributing, and management in the several towns for the year ending March 25, 1892: Ashton-under-Lyne, 2s. 3·35d.; Dukinfield, 1s. 5·76d.; Stalybridge, 2s. 8·35d.; and Mossley, 3s. 0·08d. In reference to the question of meter-rent charges, Mr. Veevers quotes some cases taken from the books of the Dukinfield Gas Department, showing how hardly these charges press upon the small consumers. In two cases in the list, the customers were charged for meter hire though there had been no consumption of gas in the quarter. In a third case, the amount paid for gas (100 cubic feet) was 4d., and for meter-rent 1s. 4d. —the total being equivalent to 16s. 8d. per 1000 cubic feet of gas. In a fourth case, the gas came to 4d., and the meter-rent to 1s., or equivalent to 13s. 4d. per 1000 cubic feet of gas. In half-a-dozen other cases which are quoted, the consumption for the half year only amounted to from 300 to 600 cubic feet, and the charges for gas and meter hire were equivalent to from 5s. to 7s. 9d. per 1000 cubic feet. Mr. Veevers effectively winds up his statement by pointing out that during the past 14 years the price of gas in Dukinfield has been reduced from 3s. 8d. to 2s. 11d. per 1000 cubic feet to small consumers, while meter-rents have also been abolished.

COLONIAL GAS UNDERTAKINGS.

We have lately received the half-yearly reports and accounts of the under-mentioned colonial gas companies; and we give from these and other sources the following particulars as to the working of the undertakings.

In the report presented at the last half-yearly meeting of the Australian Gaslight Company, the Directors stated that the operations of the concern in the six months ending June 30 had been fairly successful, notwithstanding the prevailing financial depression. The profits, together with the balance from the previous account, amounted to £53,950; and out of this a dividend of 9s. per share for the half year was recommended. This would absorb £51,130, and leave a balance of £2820 to be carried forward. The Engineer (Mr. T. J. Bush) reported that the manufacturing and distributing plant have been maintained in good and serviceable condition. The Directors expressed their pleasure in announcing that they had determined on reducing the price of gas sold by meter 3d. per 1000 cubic feet as from the 1st ult.—a concession which would, they said, make a difference of £14,000 per annum.

The Directors of the Brisbane Gas Company had a less satisfactory statement to submit to the proprietors at their half-yearly meeting. In February last the works were considerably damaged by floods; and a large expenditure consequently became necessary for repairs. In view of the general depression in the value of real property, the Directors recommended that the value of the works should be reduced in the books by £11,000—£6000 to come from the reserve fund, and £5000 from the balance of the profit and loss account. The balance (£2850) to the Company's credit in their account with the London Chartered Bank of Australia, which had temporarily suspended payment, was not available; and the Directors recommended a dividend of 4 per cent.

The report of the Directors of the Launceston (Tasmania) Gas Company for the half year ending June 30 last, which was presented to the shareholders at their meeting on Aug. 4, opened with an expression of regret that the usual increase had not taken place in the consumption of gas. The last reduction in price and the greater cost of coal resulted in a considerable diminution in the profits for the half year. On Dec. 31, 1892, the amount standing to the credit of the profit and loss account was £36c9, out of which £2500 was paid as an interim dividend and £93 as dividend tax. The credit balance on June 30 was £3137; and the Directors recommended a dividend at the rate of 10 per cent. per annum. The quantity of coal carbonized on the works (which are under the supervision of Mr. T. S. Cleminshaw) in the six months covered by the report was 2578 tons 3 cwt. of Newcastle, and 96 tons 2 cwt. of shale; the quantity of gas manufactured being 26,901,700 cubic feet, or 10,055 cubic feet per ton, of 18·85-candle power. The Chairman (the Hon. W. Hart), in moving the adoption of the report, referred to the falling off in the consumption of gas during the half year, which amounted to 3,161,000 cubic feet as compared with the corresponding period of 1892. Of course, in that year the exhibition was in progress, and 2,016,100 cubic feet of gas were consumed there. Comparing the past six months with the half year ending Dec. 31, 1892, there had, he remarked, been a falling off of 1,989,000 cubic feet; and no doubt this was to be accounted for by the general depression. The Directors had made a reduction in the price of gas for a time; and it had necessarily been an advantage to the consumers. But it represented a loss to the Company of £1000 per year; and an extra duty on coals of £550, and additional wharfage rates of £137, made a total of £1687. He trusted they would have an increase during the coming half year. The Directors were only able to recommend a dividend of 10 per cent.; and to pay it they had had to encroach upon the amount carried forward. The report was adopted; and the dividend recommended was declared. Resolutions were then passed authorizing the Directors to borrow money, and to increase the capital to the extent of £10,000.

The report of the Directors of the Rockhampton (Queensland) Gas and Coke Company, Limited, for the half year ended June 30 last is specially interesting from the fact that the Company have an electric light undertaking in conjunction with their gas business. The Directors state that, taking everything into consideration, the results of the working in the period named were very satisfactory. With the gloomy and unprecedented state of financial matters characterizing the latter part of the half year, and the consequent depression and insecurity in commercial affairs generally, the Directors had somewhat feared the Company would have felt the effects very much more seriously than had been the case. The gas business resulted in a profit of £1940. The electric light operations show an actual loss of £115, to which is added £289 interest upon the capital involved in the electric light plant, buildings, &c.; making a debit balance in all of £414. The net profit for the whole of the Company's business is therefore £1526. A great improvement appears in the electric light revenue as compared with that of the preceding half year; while the working expenses are much reduced. The number of customers for the light is increasing; and public lighting with high-power arc lamps will soon be inaugurated on the Fitzroy Bridge. In view of the large sum vested in the gas interests, the Directors have thought it inadvisable to push the electric lighting operations, but have preferred to allow this portion of the business to expand on its own merits, and in response only to unsolicited applications for the light. They anticipate being able to report an actual profit upon the electrical business at the next meeting of shareholders. The gas consumption for the half year was slightly below that of the corresponding period of last year; but every attention is being directed to the extension of this portion of the Company's undertaking, and particularly in those outside and scattered districts where the gas-mains are already laid, but, comparatively speaking, little used. Special concessions are to be made in these districts, to induce the residents to become consumers of gas. The Directors recommend the payment of a dividend at the rate of 10 per cent. per annum, amounting to £1724, which will necessitate the appropriation of £200 of the reserve fund.

SOME NOTES FROM AMERICA.

By Our Own Correspondent.

The advocates of municipal lighting in America have always found a serious obstruction to their logic in the price of gas in Philadelphia; the figure—$1·50—not comparing favourably with $1·25 in New York, $1 in Boston, and relatively low prices in other large cities. It now appears that there is a chance of a reduction in the price; Director Windrim having sent a communication to the Mayor of Philadelphia urging that the charge should be brought down to $1·25. He also recommends that the city should buy the plant of the Company, who supply gas wholesale to the city. On the question of price, it is to be noted that even the proposed figure would not be very low for a city like Philadelphia, making as it did last year 3584 million cubic feet, and situated as close as it is to the coal-fields. Much of the coal used in Boston and its vicinity passes through Philadelphia, and thus has to bear the expense of freightage from that point to where it is to be used, in addition to the cost at Philadelphia. This alone is quite an item. The figures offered by Director Windrim show an estimated make of gas for 1894 of 3985 million cubic feet. Of this quantity it is expected the city will manufacture 2093 millions, and buy 1892 millions; and he estimates it will cost to make the former amount, and distribute all the gas, including the 1892 millions purchased, $3,242,000.

The gas bought is paid for at the rate of 37c. per 1000 cubic feet; so that the average cost of manufacture and distribution is about 96 c. Hence, if the matter of interest is to be left out of consideration, it is certainly proper that a reduction should be made rather than have the surplus applied to the lowering of rates or the building of bridges and highways. As a matter of fact, it is fair to say that, if the amount spent on the works were capitalized, the interest would absorb the apparent profit. As to the second recommendation—viz., that the City should purchase the plant now owned by a private Company, who sell gas wholesale to the Gas Department—I would suggest that the question could be treated more intelligently, if the report showed just what was the cost of making the 2223 million cubic feet of gas manufactured by the City last year. The mixing up of items belonging to manufacture with those chargeable to distribution makes it impossible to get this information. If, however, the labour account can be taken as a guide, I would suggest that the less gas the City makes the better off it will be; for this item, which apparently includes only stokers, purifying-house men, and coke wheelers, figures out to 23c. per 1000 cubic feet. It is the old story over again. It costs an American city more to do work when it employs its own help than it does if the job is given out by contract.

With regard to the forthcoming annual meeting of the American Gaslight Association, at Chicago, the notices for which have been issued, I notice that three out of the four papers promised deal with purification—certainly a very interesting and important part of the process of gas manufacture. I await the reading of these papers with considerable interest; and I trust—and, from the names of the authors, I am sure my faith will not be in vain—the subject will be treated

very thoroughly. As the gas managers of several of the cities are under laws in regard to the impurities in gas, and as many of them using oxide of iron alone are sometimes troubled to keep down to the requisite number of grains of sulphur, it is to be hoped that, after listening to these essays, they will know more than they now do in regard to the laws governing the removal of sulphur compounds by iron oxide.

It appears that Montreal is in a fair way to have the benefit (?) of a competing gas company. The parties at the back of the new scheme are Messrs John Coates and Co., who agree to furnish 21-candle gas for $1 per 1000 cubic feet. All things considered, this may be said to be a fighting price.

The City of Detroit (Mich.) has for some time been fighting the Gas Company; and the culmination of the trouble has been an attempt on the part of the City to impose a new ordinance upon the Company, which would require the latter to supply illuminating gas at 80c. per 1000 cubic feet net, and natural gas at 30c. net per 1000 cubic feet. One peculiar feature of the ordinance is that, if the gas shall be of less than 18-candle power during any month, the consumer's bill shall be discounted proportionally. Of course, this is another instance of the incapacity or injustice, or both, shown by a municipal authority in dealing with the gas question; as, considering the geographical position of Detroit, it would be impossible for the Company to make a living at this figure, and, furthermore, the ordinance places the operations of the Company almost entirely in the hands of the Board of Public Works. This Board would have absolute control of the pressure under which gas would be supplied, and would have power to condemn all meters and other apparatus as they saw fit. It is hardly necessary to say that the ordinance has been rejected by the Company; and it now remains to be seen what the next move will be.

Gas matters in Boston are quiet at the time of writing. Whether this quietness portends an early settlement of all troubles, or is merely ante-storm calm, remains to be seen; but the indications are that matters will go along quietly. The Brookline Company, who have the right to lay pipes in one part of Boston, are busily at work; and the people are beginning to "catch on" to the idea that allowing a company to come into a city and lay pipes parallel wtih those already down has some disadvantages. The truth is that Boston has some very fine road beds, and the laying of these pipes is seriously affecting them. The evil is of such a nature that the City Government has taken action to hold in abeyance the permits given to the Company to dig up certain macadamized streets. Another evil is also making itself apparent. Where there are two lines of main in one street, it is somewhat difficult to locate leaks, and the work is not attended to very promptly, so that there is a great deal of unnecessary digging up of the roads. These are evils which might have been foreseen, and have caused the powers that be to find some other way to set right supposed wrongs. In the meantime, a Board of three gentlemen are endeavouring to arrive at the value of the Bay State Gas-Works. It will be remembered that the last Legislature decided that a certain note for $4,500,000 given by the Bay State Company should be cancelled, and that the Company should issue capital to the amount of the value of the plant; these commissioners are now trying to arrive at the value of the plant. Much expert testimony has been offered by the Company. It is stated that the capacity of the plant is 5,500,000 cubic feet per day, and its value is put at various figures by the witnesses—some placing it as high as $5,500,000. When the evidence has been completed, I may refer to the subject again.

We meet some interesting discussions now-a-days, between the managers of gas and water companies on the one hand and electric traction corporations on the other, as to the question whether or not electricity destroys iron pipes in the ground. In some cities the experience in this direction has been very serious; whereas at other places little trouble seems to have been caused. The difficulty appears to increase with the quantity of business done by the traction company. It is, of course, aggravated by poor track laying, and is alleviated in places by the running of return wires. If the use of electricity increases during the next five years as much as it has done during a like period now passed, there will need to be some way devised to meet the difficulty.

In the action of the Edison Electric Light Company and the Edison Electric Illuminating Company, both of New York, against the Mount Morris Electric Light Company and the United States Electric Light Company of the same city, Judge Lacombe has handed down a decision granting the preliminary injunction asked for to prevent the latter Companies using the Edison lamp.

Projected Extension of the Bury Gas and Water Works.—The Bury Town Council have decided to go to Parliament next session for powers to carry out a number of local extensions and improvements. Among other things they propose to increase the general borrowing powers on gas-works account by £35,000; while in connection with the water-works, they will ask Parliament to extend the time allowed by previous Acts for the completion of the works, and to sanction the purchase of land for the pipe-line.

Defaulting Water Consumers.—At the Thames Police Court last Thursday, a number of persons were summoned at the instance of the East London Water Company for non-payment of their water-rates. It will probably be remembered that some time ago the Company, with a view to preventing inconvenience to the public, decided that, in the event of the rates not being paid, they would proceed against defaulters by summons, instead of cutting off the water as had hitherto been the practice. Mr. G. Kebbell, Solicitor to the Company, prosecuted. Mr. Fawes, of 580, Mile End Road, was summoned for non-payment of two quarters' water-rate, amounting to £1 14s. Mr. Kebbell, after the case had been proved, asked for costs. He explained that the Company had determined not to cut off the water in any instance; and his object in applying for costs was to let defaulters know that they could not defy them. If they were only allowed the costs of the summons, he was afraid hardly anyone would pay until he received one. Mr. Rose said the Company were clearly entitled to costs. An order would be made for the payment of the rate, with 8s. costs. The same amount of costs was imposed in several other cases.

THE GAS AND WATER ORDERS OF THE PAST SESSION.

The report of the Board of Trade on their proceedings under the Gas and Water Works Facilities Act, 1870, during the past session, has lately been issued. It states as follows:—

In December, 1892, 15 applications for Provisional Orders under the Gas and Water Works Facilities Act, 1870, were made to the Board of Trade—eight relating to gas, and seven to water undertakings. The following is a list of the applications relating to gas: Bromyard, Llanfairfechan and Aber, Newent, Otley, Portishead, Sheffield, Sligo, and Swindon.

Five of the applications were in respect of undertakings already existing without parliamentary authority, and sought for such authority to maintain the existing works, and continue the manufacture and supply of gas—viz., Bromyard, Llanfairfechan and Aber, Newent, Portishead, and Swindon. The Bromyard Company desired power, in addition, to construct further works. One of these applications (the Llanfairfechan and Aber) was promoted by an individual.

The Otley, Sheffield, and Sligo applications related to undertakings already authorized by Parliament. The Otley application sought for power to purchase additional lands, to sell gas in bulk beyond the limits of supply, and to extend the borrowing powers of the Company; the Sheffield application was for power to construct additional works, and to create and issue debenture stock; and the Sligo application, for power to raise additional capital, and to extend the authorized limits of supply.

The aggregate amount of capital which it was desired to raise was £74,657 share and £221,614 loan, including debenture stock.

Objections were lodged against all the applications, except the one in respect of the Otley Order; and they were duly considered. It was not found necessary to hold a local inquiry in any case; and, subject to certain modifications and amendments, the Board of Trade granted all the applications.

The sliding-scale of price and dividend was adopted in three Orders; the initial price per 1000 cubic feet being fixed in the respective Orders as follows: Portishead, 4s. 6d., subject to the maximum mentioned below; Sligo, 5s.; and Swindon, 4s. 3d. In four Orders, a maximum price per 1000 cubic feet was fixed as follows: Bromyard, Llanfairfechan and Aber, and Newent, 5s. 10d.; and Portishead, 5s. 3d. In the Llanfairfechan and Aber and Newent Orders, power was reserved to the Board of Trade to vary the maximum price after three years, or to substitute a sliding-scale.

The supply of gas in bulk beyond the limits of supply, subject to the usual limitations, was authorized in the Llanfairfechan and Aber, Otley, Sligo, and Swindon Orders. The limits of supply in the Portishead Order include portions of the authorized limits of the Bristol Gas Company, in which that Company have not exercised their powers. No objections were lodged against this provision by the Local Authorities concerned or by the Company. In the Llanfairfechan and Aber Order, the promoter being an individual, a provision was inserted that no sale or assignment of the undertaking should have effect until approved by the Board of Trade. The Orders contain the usual clauses as to the sale of additional capital by auction or tender, limits of dividend, the creation of insurance and reserve funds, illuminating power, the testing of gas, the quantity of land to be taken by agreement, &c. Where necessary, the Gas-Works Clauses Acts, 1847 and 1871, were incorporated.

Two Bills to confirm the Orders were submitted to Parliament; both being introduced into the House of Lords on the 4th of May. The Confirmation Bills passed through the various stages without opposition, and received the Royal Assent on the 27th of July.

The applications for Water Provisional Orders were as follows: Hoylake and West Kirby, Llandrindod Wells, Maidenhead, Newington, Pocklington, Poole, and South-West Suburban; and an Order was granted in every case.

The applications in respect of the Hoylake, Llandrindod, and South-West Suburban Orders were for authority to raise additional capital only; the Newington and Pocklington applications were for power to construct new works and to raise additional capital; the Maidenhead application, to extend the limits of supply, and raise additional capital; and the Poole application, to extend the limits of supply, construct new works, and raise additional capital. In certain cases, the Board of Trade were not satisfied that the whole amount of additional capital applied for would be required within a reasonable time; and reductions were accordingly made.

The Llandrindod application was opposed by the Local Authority, who objected to the quality of the water and the sources of supply. The Board of Trade being satisfied, however, that the capital powers of the Water Company were exhausted, and that further capital was necessary to enable them to fulfil their obligations, granted the Order, but reduced the amount of additional capital to £1000 by shares and £250 by loan, and lowered by 1 per cent. the proposed maximum dividends.

The Newington Order was a revival of an application made in the previous session; and it was granted with an intimation to the promoters that the fact of this being done was not to be held to prejudge the case of the Corporation of Hull in respect of alleged interference with their sources of supply. This intimation was given because circumstances had prevented the Corporation from stating their case at the Board of Trade inquiry on the application of the previous year.

Two Bills to confirm the various Orders were introduced in the House of Commons on the 5th of May. Bill No. 1 passed through both Houses without opposition, and received the Royal Assent on the 29th of June. The rejection of Bill No. 2 was moved in consequence of objection to the Llandrindod Order; but the second reading was carried after a division. Petitions were presented against the Llandrindod Order by the Local Board (not praying to be heard), and against the Newington Order by the Corporation of Hull. On the motion of Mr. Frank Edwards, member for Radnorshire, the House of Commons adopted an instruction directing the Committee to divide the Bill into two portions (one to contain the Llandrindod Order alone), and to report them separately to the House; and another empowering the Committee to insert a clause enabling the Local Board to purchase

the undertaking of the promoters at a price to be settled by arbitration in case of dispute between the parties. The Bill was divided in accordance with the instruction, and reported as two Bills—Nos. 2 and 3. The Select Committee reported in favour of the confirmation of both the opposed Orders, with amendments; an agreed purchase clause being inserted in the case of Llandrindod. The Newington Order was again petitioned against by the Corporation of Hull in the House of Lords. Ultimately the promoters and the Corporation agreed upon a purchase scheme; and the Order was amended to give effect to it. Bills Nos. 2 and 3 received the Royal Assent on the 27th of July.

Following the report is a table showing the number of Orders made by the Board of Trade since the passing of the Gas and Water Works Facilities Act in 1870. In the 23 years which have since elapsed, 403 Orders have been applied for, and 378 made by the Board of Trade, of which 372 have been confirmed by Parliament. The total amount of fees received with the applications has been £28,490.

THE CRISIS IN THE COAL TRADE.

We give below a further epitome of the progress of events in the long-pending dispute in the coal trade, which, as will be seen, is now happily drawing to a close.

The great event of the past week was the conference of the Mayors of the industrial centres of the North with the representatives of the coalowners and the miners, which took place on Monday at the offices of the Town Clerk at Sheffield. The meeting excited great interest. A crowd of working men, principally colliers, assembled outside the building, and kept their places for four hours. When the coalowners arrived, they were received in silence; but cheers were raised when Mr. B. Pickard, M.P., entered the offices. The Mayors of Sheffield, Leeds, Bradford, Nottingham, Derby, and Barnsley met at one o'clock, and held a preliminary meeting. The conference commenced at three o'clock—there being present the six Mayors and the appointed representatives of both Federations. The proceedings were conducted in private, and no information was given until seven o'clock, when the meeting broke up. The following official report was then communicated: The Mayors of Leeds, Sheffield, Bradford, Nottingham, Derby, and Barnsley met at the Town Clerk's office, Sheffield, at one o'clock this afternoon, and, after consultation, formulated a number of suggestions. At three o'clock the representatives of the Coalowners' and Miners' Federations met them; and the Mayor of Sheffield was voted to the chair. He opened the meeting with a few words of welcome, and suggested that it might be desirable for the representatives of the coalowners and miners to have a quiet conversation on the position of affairs prior to the Mayors' suggestions being laid before them, with a view, if possible, of their coming to an agreement without the intervention of the Mayors. This suggestion was adopted; and the Mayors retired. The representatives of the two bodies discussed the question between themselves for about two hours, and then requested the Mayors to return. It appeared that the representatives had not agreed upon any basis of settlement; and they requested the Mayors to lay their suggestions before them. This they did; the suggestions being as follows:—

(1) Seeing that the price of coal will not at once recede (except in cases where contracts are pending) to the prices prevailing prior to the strike, the miners be allowed to commence work at the old rate of wages, and that the miners submit to a reduction of 10 out of the 40 per cent. advanced since 1888 six weeks after the pits are open and free for work—say, on and after Monday, Dec. 4, 1893.

(2) That all men be allowed to return, where possible, and as far as practicable, to their former places.

(3) That the representatives of the Miners' Federation be requested to ballot the men (with the least possible delay) upon the proposed suggestions.

(4) That the Coalowners' Federation be requested to issue, at the earliest possible moment, pit-head and other notices that pits will be opened on the suggested terms.

(5) That representatives of the Miners' and Coalowners' Federations should meet at an early date to formulate a scheme for the establishment of a tribunal of conciliation, with a view of dealing with the question of wages.

(6) That, as soon as it is decided to open the pits for the resumption of work, the coalowners be requested, in consideration of the severe distress now prevailing in the mining districts, to make advances to the men—such advances to be repaid by weekly instalments.

The representatives of the coalowners promised to lay these suggestions before the meeting of their Executive and Federation to be held at Derby on the following day; and the miners' representatives agreed to bring them before their Executive, with a view of taking an early ballot thereon. A cordial vote of thanks to the Mayors was passed, on the motion of Mr. A. M. Chambers, seconded by Mr. Pickard. This was acknowledged by the Chairman, and also by the Mayor of Leeds (Mr. Alderman Ward). The Mayor of Sheffield subsequently stated that the discussion had been carried on in a very friendly and kindly spirit, without the introduction of a jarring word. He seemed thoroughly pleased with the day's work. Speaking at a meeting held on Monday night, he said he had been exercising his mind, and, he might also say, his heart, during the previous eight or nine hours in trying with his civic colleagues to bring about a satisfactory settlement of the strike. He had reason, and the whole of his colleagues had reason, to hope that they could now see the beginning of the end. He could assure them that they entered upon the work with fear and trembling. They were anxious to do justice to the miners, who were not too well paid, and to the masters, who had the difficulties of depressed trade to contend with. He thought they had formulated such suggestions—which, he might say, were unanimously agreed to by the Mayors—as the country, as a whole, would look upon as fair and honourable between employers and employed. He sincerely hoped that those who could influence this important question would do so in favour of peace, and of bringing about a just and satisfactory settlement of one of the greatest labour struggles that had ever occurred in this country. A conference of Durham coalowners and men's representatives was held at Newcastle to consider the application of the men for an advance of wages, which had stood adjourned for some time. The conference lasted all day, and was ultimately adjourned until Thursday. It was believed that the employers desired to ascertain the result of the Midland conference before replying to the men's request. A meeting of the Butterley Company's colliers was held at Ripley to consider a notice that the pits would resume work on the following day, and that all men who did not resume work must fetch out their tools. The notice said nothing about the rate of wages. Mr. Haslam, a Derbyshire agent, said he had telegraphed to the Manager asking what the terms were to be, and stating that the men would not accept a reduction. The Manager replied that he was "bound by his Federation." A resolution was unanimously passed pledging the meeting not to go to work unless the old wages were promised. The Company employ 2500 men in Derbyshire and Notts. Several small pits in the locality were working at old rates. On the London Coal Exchange, the result of the Sheffield conference was awaited with much anxiety. Official quotations remained unaltered for seaborne coal; but the prices of gas coal, with limited supplies, were firmer than ever, and 6d. to 1s. per ton advance was made for the small quantity available—15s. per ton *ex* collier being paid. With regard to the proposal as to Government interference, the Press Association reported that Sir Courtenay Boyle, of the Board of Trade, was using his influence to bring about conciliation between the coalowners and miners. The Government, it was positively stated, would not move unless both parties were agreed that such action would be desirable. But Sir Courtenay Boyle was in communication with leading men on both sides; and it was believed that the Government could rely on the services of two prominent unbiassed politicians, with a view to conciliation rather than arbitration.

On Tuesday, a largely-attended meeting of coalowners was held at Derby, under the presidency of Mr. A. M. Chambers, to consider the result of the Mayors' conference on the previous day. Mr. Chambers reported the suggestions made that the men should resume work at the old rate of wages, and that the coalowners and men should endeavour, immediately after the resumption of work, to try and devise a means of dealing with the wages question which will prevent such dislocation of trade as at present exists. It was decided that the first suggestion—as to the resumption of work—could not be entertained. The proposals of the Mayors were then considered, and it was unanimously resolved as follows:—

That the coalowners record their grateful acknowledgments to the Mayors of Sheffield, Leeds, Bradford, Nottingham, Derby, and Barnsley, for their intervention and suggestions of terms as a basis for the settlement of the present labour dispute.

That, while reaffirming their conviction that the state of trade entitled them to the reduction asked for, and regarding the present inflated prices as entirely artificial, yet, with the object and desire to end the widespread distress and general dislocation of trade, and in deference to the appeals made to them as contained in the suggestions of the Mayors, they make the following offer: (1) That the miners be allowed to commence work at a present reduction of 15 per cent. out of the 40 per cent. advanced in 1888, and that pit-head notices be given on Thursday next [Oct. 12] that work can be resumed on Monday, Oct. 16, at that reduction; (2) that all men be allowed to return, as far as practicable, to their former places; (3) the coalowners agree to meet the representatives of the miners at an early date, and to use their best endeavours to formulate and agree upon a scheme for the establishment of a tribunal of conciliation, with the view of dealing with the question of further advances or reduction in wages; (4) that a copy of this resolution be forwarded to the Mayor of Sheffield, to the Secretary of the Miners' Federation, and to the Press.

At a well-attended meeting of the Warwickshire masters, under the presidency of Mr. Reuben Smallman, at Atherstone, it was decided, in consequence of the conference at Sheffield, to open the pits at the old rate of wages, subject to a 10 per cent. reduction on Dec. 4. At the Pooley Hall Colliery, at Polesworth, the proprietor invited the men to resume work at a 5 per cent. reduction now and another on Jan. 1, 1894, subject to a general settlement. At a large meeting of colliers held at Prescot, Mr. S. Woods, M.P., read the suggestions made at the conference, and said he agreed with every one of them, except the reduction. He told the Mayors frankly at the time that, from his knowledge of the determination of the men, they would not accept it. He also told them that he thought the part of the suggestions which related to the 10 per cent. would defeat the scheme. He suggested as follows: That the clause should be withdrawn; that the men should go to work at the old rate of wages; that afterwards a Conciliation Board should be formed to deal with the price of coal in the future; that neither party should be pledged to anything, but that, after a certain time, if the masters found themselves in difficulties, any proposition they made would receive the fullest consideration at the hands of the men. The Ashton Moss Colliery, situated at Ashton-under-Lyne, recommenced work on Tuesday at the old rate of wages; and the proprietors of the Peel Hall Collieries, Little Hulton, near Bolton, intimated that their men might return to work on similar terms. This makes the eighth colliery to resume work in the Bolton district. About 1000 Leicester colliers met at Coalville to hear an address from Mr. Ben Tillett. In supporting a resolution declining to accept any reduction of wages, Mr. Tillett condemned the proposals made at the Sheffield conference, and said the colliers would be foolish to go in at lower wages now when they were so near victory. If they did, they would have the fight all over again before very long. The idea that prices should govern wages was wrong in principle. Wages ought to be the main element in determining prices. He counselled firmness until the battle was over.

A special conference of the delegates of the Lancashire and Cheshire Miners' Federation was held at Wigan on Wednesday, to consider the Sheffield proposals. Mr. S. Woods, M.P., presided. The meeting was private, but crowds of miners gathered near the conference room; and the general feeling among them was that no reduction should be countenanced. The result of the conference was subsequently communicated to the reporters. The delegates recorded a grateful acknowledgment to the Mayors for their intervention and for their suggestion of a basis for a settlement of the present labour dispute, and agreed to accept some of the proposals. The following resolutions were also passed: "(1) Seeing that the price of coal will not at once recede, except in cases where contracts are pending, to the prices prevailing prior to the strike, miners be allowed to commence work at the old

rate of wages. (2) That all men be allowed to return, where possible, and as far as practicable, to their former places. (3) That the Coalowners' Federation be requested to issue at the earliest possible opportunity pit-head and other notices that their pits will be opened on the above terms. (4) That representatives of the Miners' and Coalowners' Federations should meet at an early date to formulate a scheme for the establishment of a tribunal of conciliation with a view of dealing with the question of wages. (5) That, as soon as it is decided to open the pits for the resumption of work, the coalowners be requested, in consideration of the severe distress now prevailing, to make advances to the men, such advances to be repaid by weekly instalments." The coalowners in the district near Liverpool on Wednesday offered to open their pits at a reduction of 15 per cent. off the 40 per cent. increase granted in June, 1888; being equal to about 10½ per cent. reduction off the gross pay. The miners professed indignation at being asked to accept a reduction of 15 per cent. when they had declined 10 per cent.; and one of the agents declared that the men would not take it. At Atherton, the coalowners' offer to reopen at a 10 per cent. reduction was rejected by the men; and, after negotiations, the masters agreed to start again at the old rate, pending a general settlement. A deputation of masters in the Tamworth coal-field had a meeting with the men; and it was then arranged to resume work at five collieries on the old terms. The arrangement affected nearly 2000 men. Work commenced on Wednesday night. The miners of Leicestershire and South Derbyshire rejected the proposals for any reduction; but the colliery proprietors decided to offer them the acceptance of the terms of the Mayors' conference in their entirety. In Nottinghamshire, about 2000 miners at the Clifton and Woollaton Collieries resumed work at the old rate; and it was expected that a large number would start again at the Babbington Collieries, owned by Colonel Seeley. He suggested that during the winter the miners should meet the owners with the view of devising a scheme which would prevent stoppages in future. Notices were posted at the Eastwood pits, Nottingham, to the effect that the miners (over 3000 in number) could return to work at once. In the Sheffield district, a proposal to reopen the Birley Collieries (where about 2000 men are usually employed) on the terms suggested at the conference was rejected by the men. In the Leeds district, and also at Birstall, near Dewsbury, a similar decision was come to by the miners. In the Leen Valley, there was great rejoicing at the withdrawal of notices; something like 10,000 men being affected thereby. It was expected that the principal pits between Nottingham and Mansfield would be fully employed by the beginning of the present week. At the Brinnington Colliery, near Stockport, the men agreed to go in at the old rate. On the London Coal Exchange, the decision arrived at on Tuesday at the meeting of coalowners was considered unfavourable to an early settlement, in face of the public utterances of the miners' representatives. Coal was arriving in increased quantities by rail and sea; while the demand, owing to the open weather, was scanty.

A special meeting of the Miners' Federation of Great Britain was held at Birmingham on Thursday, to consider the proposals made at the Sheffield conference for the settlement of the dispute. Mr. B. Pickard, M.P., presided over a full attendance of delegates; all the districts affiliated with the Federation being represented. Mr. S. Woods, M.P., was unable to be present through illness. The proceedings were private; but, at the close of the meeting, the following communication was made to the representatives of the Press: The action of the Sub-Committee in attending the Mayors' conference at Sheffield was endorsed, and a vote of thanks to the Mayors for convening the meeting was carried unanimously. The following resolution was also unanimously carried: "That this conference, while recognizing and appreciating the good intentions of the Mayors, at the same time are still of opinion that no reduction of wages is necessary, and none can be accepted; and, further, we call upon all men to stay away from any colliery unless and until opened at the old rate of wages." A vote of sympathy with Mr. S. Woods, M.P., was passed. The conference then adjourned until the following morning. A fully-attended meeting of the Cannock Chase and District Coalowners' Association was held in the course of the afternoon, at Birmingham, to consider the Sheffield proposals and the counter-proposal of the Masters' Association. It was decided to adhere to the notice for a reduction, which, in that district, affects 10,000 men. A telegram was received from the Yorkshire, Lancashire, and Derbyshire Associations, stating that they were determined to hold out for 15 per cent. reduction. A large number of miners in the county of Nottingham resumed work at the old rate of wages on Thursday; and it was expected that several thousand more would begin working almost immediately on the same terms. It was estimated that altogether there were 13,000 men at work in Nottinghamshire. In the adjoining collieries of Leicestershire, very few men had returned; and a number of proprietors were holding back their decision in the hope that the miners would agree to resume on the terms suggested at Sheffield. The latter, however, expressed their determination only to return to work at the old rate unconditionally. For the first time since the strike began, the coal trains running on the Midland Railway were fairly numerous on Thursday; and the traffic was being dealt with very expeditiously, in order to get the coal to the centres where the scarcity is the greatest. At a meeting of about 2000 miners employed at the Birley Collieries of the Sheffield Coal Company, it was resolved to reject the proposal of their employers, based on the Mayors' suggestions on Monday, and abide by their former resolutions not to accept any reductions. It was also decided that no men other than those authorized by the Federation should go to work, except at the old rate of wages, and without conditions. In Derbyshire, notices were posted to the effect that certain pits would reopen on the 16th, at a reduction of 15 per cent. out of the 40 per cent. advances since 1888; but the men regarded the offer as useless in view of their determination not to accept any reduction whatever. Similar offers were made elsewhere, and rejected. The Pilsley Company, however, decided to open their collieries at the old rate; the only condition being that the men should accept a reduction if this course were eventually generally adopted. Representatives of the Durham Miners' Federation Board and the Wages Committee of the Durham Coalowners' Association met at Newcastle on Thursday to discuss the demand of the former for an advance of wages. The Owners' Committee said they were prepared to recognize the advantage which both owners and men had derived from steadily working on during the weeks of excitement and unsettlement; and the owners were, under the circumstances, willing to give for three months, commencing from the 16th or the 23rd inst., a special advance of 5 per cent. on basis rates. The men retired, and, on their return, handed in the following resolution: "That the Federation Board cannot accept the suggestion of the owners to give an advance in the manner proposed, as we object to its being limited in duration, seeing that, in the past, changes in wages have not been for any period, and have always been stated in fixed percentages. But we are willing to settle the present wage dispute by an immediate advance of 5 per cent.—thus raising the 20 per cent. to 25 per cent. above the 1879 basis; it being understood that it is competent for either party to reopen the question at the end of three months. If this be not granted, we shall feel ourselves bound to place the whole matter before our members." The Owners' Committee stated that they were unable to make any alterations in their resolutions; and the proceedings terminated without a settlement. The result caused great disappointment among the miners. Mr. J. D. Sym, of Edinburgh, the Arbiter chosen by the coalowners and miners of Mid and East Lothian in regard to the demand of the miners for an advance of 20 per cent. on their rate of wages, issued his award on Thursday. He finds that a further advance in wages than that of 10 per cent., which was agreed to by the employers as from the 23rd of August, is not justified by the state of trade; and he therefore awards that no advance is due.

The conference of the Miners' Federation at Birmingham resumed its sitting on Friday morning. As on the previous day, the proceedings were conducted with closed doors; but the results were afterwards communicated to the representatives of the Press. Mr. B. Pickard again presided. The delegates present represented about 230,000 men, including the Coal Porters' Association of London. It was moved by Yorkshire, and seconded by Lancashire—"That we hereby agree to resume work on the old terms. The men, after resuming work, are willing to meet the coalowners to try to devise means whereby dislocation of trade may not occur, such as is now in existence. That this resolution be forwarded to Mr. R. T. Ellis, Secretary of the coalowners; that he be further informed that we reaffirm the resolution carried at Chesterfield, and which ran as follows: We agree to take the old rate of wages as the normal condition of wages, and pledge ourselves not to seek any advance on the present rate of wages until the 1890 and 1891 prices are realized." This proposal was carried unanimously. Resolutions were then passed thanking the Press for their support, confirming the decision of the Chesterfield conference demanding a levy of 1s. a day from all miners who have resumed work, and expressing regret at the suffering caused "by the miners being locked out by the Coalowners' Federation;" and the proceedings closed with a vote of thanks to the Chairman. Several of the leading delegates, in answer to inquiries, gave it as their opinion that the strike would not end before Christmas. The miners' official estimate showed that 59,750 men, out of the 271,000 men in the various districts connected with the Federation, had returned to work; these numbers being exclusive of the Forest of Dean men. At Sheffield, a large meeting of coalowners took place at the Royal Victoria Hotel. Although only South Yorkshire owners were summoned to the meeting, others were present from West Yorkshire, North Derbyshire, and Nottinghamshire. Mr. A. M. Chambers occupied the chair. A long discussion took place on the present condition of affairs. Many speakers condemned the action of those owners who had allowed their men to return to work at the old rates, and others criticized the conduct of those who had offered to open their pits on the terms set forth in the Mayors' proposals. The meeting, by a large majority, passed a resolution confirming the decision they came to at Derby, to allow the pits to be reopened at 15 per cent. reduction. At various places, offers were made to reopen pits on this condition; but they were rejected by the men. On the London Coal Exchange, a reduction of 8s. per ton on all classes of house coal was agreed to.

No fewer than 43 Yorkshire coalowning firms announced on Saturday their intention to throw open their pits on Monday for those miners who were willing to resume work at a modified reduction of 15 per cent. on the 1888 prices, as agreed to at the Derby conference. There was, however, no likelihood of any of the men returning on these terms. With the exception of 2000 or 3000 men employed at various collieries, the whole of the miners in the county of Nottingham had resumed work; and the greatest activity prevailed. The colliery owners of Leicestershire and South Derbyshire met at Ashby-de-la-Zouch, and agreed to open the pits at once to the men—work to be resumed at the old rate of pay pending a definite settlement. This proposal led to a favourable response from the miners' agents; and it was anticipated that almost all the pits would be reopened yesterday morning, and the 10,000 miners affected would return to work. A deputation from miners of Ripley (Derby) waited upon the proprietor of the Pentrich Colliery, on Saturday, at his request, with reference to resuming work. He told them that he was willing to withdraw the notices he had given, and that the men might resume work at the old rate of wages. The offer was accepted. In the St. Helen's district, the men expressed their determination not to go back to work except at the old rate of wages.

A labour demonstration was held in Hyde Park on Sunday afternoon, in aid of the fund for the relief of the colliers on strike. Contingents marched from various parts of London; and a large number of trade and other organizations were represented. Men and boys with collecting-boxes circulated among the crowd, both on the line of the various processions, and in the park itself. Speeches were delivered from extemporized platforms by several orators, among them Mr. John Burns, M.P., Mr. T. P. O'Connor, M.P., and Dr. Clifford. The proceedings (which, so far as the speaking was concerned, did not last more than an hour) were quite peaceable throughout. Meetings were also held in many different parts of London, at which collections were made on behalf of the strikers.

Coming now to the effect of the strike on gas-works, at the meeting

of the Gas Committee of the Birmingham City Council, on Monday last week, it was stated that, with the supplies coming in, there was enough coal at the works to last until about the middle of November. In consequence of the great demands by new customers, coke and breeze of all kinds were advanced 2s. 6d. per ton. So keen was the desire to obtain coke, that the Committee feared they would not be able to continue to supply it at any price for long. At the meeting of the Heywood Town Council on Wednesday, it was reported that the Gas Committee had been compelled to make purchases of coal in the open market. In order to economize the use of gas as much as possible, it had been decided to light only half the public lamps—using every alternate one. Mr. Chadwick strongly protested against the action of the colliery proprietors, who, while failing to fulfil contracts, were selling coal at an extravagent price to other people. He did not know whether or not the position of these gentlemen was legal; but he should like to see the case tried. Alderman Heywood pointed out that their contracts contained the strike clause. Mr. Chadwick said he was aware of this; but his point was that, as the owners had coal, they ought to send it to those who had contracted for it at a certain price. His opinion was that their action was illegal; and he should certainly like to see the point raised. The matter was left with the Gas Committee. At a meeting of the Leeds Gas Committee last Thursday, it was reported that there was at each of the stations a fortnight's stock of coal; and further supplies were ordered. In Manchester there are several weeks' supply in store; and no difficulty as to procuring more coal is anticipated. With regard to coke, 15s. per ton, or 9d. per hundredweight, was charged at the gas-works last week for such coke as was for disposal, because the Corporation are bound to fulfil their contracts to the large consumers. The Managers at the various stations had imperative orders to attend to the wants of the poor and needy; and those who could not be served one day were furnished with tickets which ensured an early turn the next. The Superintendent (Mr. C. Nickson) was at the Gaythorn station last Tuesday morning before nine o'clock, and there was not a piece of coke in the yard. At the other stations a very similar state of things prevailed. At Nelson, last Thursday, there was only sufficient coal at the gas-works to meet the immediate requirements of the town; and there was every probability of the manufacture of gas having to be suspended. At the Raunds Gas-Works, the stock of coal was so short on the 7th inst. that public lighting of the town had to be discontinued; and it could not be resumed last week. At the meeting of the Southport Town Council last Tuesday, it was stated that during September the average price paid for coal at the gas-works was £1 os. 4d. per ton, and that during the present month it had averaged £1 os. 11d. Last year the average price was 12s. 5d. Alderman Fisher, who furnished these figures, stated that the Gas Committee had placed orders for a temporary supply, which would tide them over the strike. Following the lead of the Derby Gas Company, the Wolverhampton Gas Company, as will be seen from the paragraph which appears elsewhere, have announced an increase in price.

The Lighting of Conisbro'.—The Local Government Board have granted their approval to the Doncaster Rural Sanitary Authority for the lighting of a defined area of Conisbro' with gas. The work is to be commenced at once; and the whole of the parish will be rated to defray the expenses.

Proposed New Reservoir for Lancaster.—At the last meeting of the Lancaster Town Council, the Water Committee recommended that a new storeage reservoir to contain about 100 million gallons should be constructed on the Blea Tarn site, and the necessary connecting mains laid, at an approximate cost of £35,000; also that, in an application to be made for a Provisional Order for the amount already spent on the Damas Gill reservoir, powers should be included for the construction of the proposed new reservoir. After some discussion, it was decided not to proceed with the application.

St. Paulo Gas Company, Limited.—In their report for the six months ended June 30 last, the Directors of this Company state that, after making due provision for depreciation, and deducting the interest on the debentures paid on June 30 last, the net profit is £11,622. From this amount £2000 has been written off to exchange account, to meet the loss caused by the depreciation of the currency assets, which have been taken as worth 10¾d. per milreis—the rate prevailing on June 30. The balance added to that brought forward makes a total of £12,769, and the Directors recommend a dividend at the rate of 5 per cent. per annum, tax free. They propose that £2000 be placed to renewals and contingencies account, and that £4519 be carried forward.

Sale of Stock in the Toronto Consumers' Gas Company.—The estimation in which the stock of the above-named Company is held by investors was well shown at a sale of 2000 new shares by auction on the 2nd inst. The total amount offered was $100,000; and it realized, on an average, $183 per cent.—three points above the market. Such was the eagerness to secure the stock, that the bidding for it was very keen; and the sale occupied only three-quarters of an hour. It is not long since the price of gas was reduced in Toronto to 80c. per 1000 cubic feet; and the result has been to enhance the value of the Company's shares. It is quite expected that, within a twelvemonth from the time this concession was made to the consumers, the stock will be at $200.

Fylde Water Company.—The 58th half-yearly report of this Company has been issued. It shows that the capital account has been increased by an expenditure of £9110, and now stands at £322,312. Water-rates and other receipts amounted in the past half year to £15,057. This included a balance of £1474 brought forward. Working expenses, &c., came to £4539. There is a balance of £10,259. A dividend at the rate of 4 per cent. per annum on the preference stock, 1891, 10 per cent. on the "A" stock, and 7 per cent. on the "B" stock is recommended. A balance of £15,000 is carried forward. The works for bringing the waters of the Calder River and the Calder Dyke to the existing reservoirs and for the filters are so far advanced that the new water has been passed through them to meet the extraordinary requirements of the district, consequent on the long drought and the enormous number of visitors at the seaside during the season.

THE RECENT DROUGHT.

Although the rainfall has been very heavy during the past few days, several towns are still feeling the effect of the protracted drought. The Water Committee of the Dublin Corporation have at length come to the conclusion that the yield at Roundwood cannot possibly be depended upon to supply anything like the quantity necessary for a lengthened period. They therefore determined last week to turn on the canal water into a selected area of the city as from yesterday. Some prejudice exists among the inhabitants with reference to the canal water; but it is absolutely unjustified. It has been certified by eminent analysts to be perfectly free from germs in any degree dangerous to health; and although said to be somewhat harder than the Vartry, it is in no sense inferior for all domestic purposes. The Grand Canal Company will be able to supply from 3 million to 4 million gallons of filtered water daily, taken partly from the filter-beds at the Fifth Lock, and partly from the filter-beds at the Eighth Lock, which were formerly in the possession of the Rathmines Commissioners. Fifteen men of the police force have been told off to assist the Committee in suppressing the waste of water in the city. Notwithstanding the heavy rainfall, the water contained in the reservoirs of the Newcastle and Gateshead Water Company continues to decline at a rapid rate, and is causing considerable anxiety. In consequence of the scarcity of water, upwards of 1000 hands were thrown idle yesterday week at the Consett Iron and Steel Works. The supply at Holyhead is still very low; and the consumers are only furnished with water for a short time each day. Indeed, some parts of the town get scarcely any water, and are supplied mainly from old wells that have been re-opened. The question of purchasing the waterworks was last week under the consideration of the Local Board. This course has been suggested by the Local Government Board; and negotiations have already been commenced. With regard to Manchester and Bradford, no further anxiety need be felt respecting the supply, although care is still necessary to prevent waste.

THE PROPOSED NEW WATER SUPPLY FOR SHREWSBURY

A Special Meeting of the Shrewsbury Town Council was held yesterday week, to receive a report from the Gas and Water Committee in reference to the contemplated new supply of water from Church Stretton. It stated that, with the view of securing that the results of their investigations might be as reliable as possible, the Committee had deemed it advisable to submit the scheme prepared by the Borough Surveyor (Mr. Eddowes), with the necessary plans, &c., to Mr. G. F. Deacon, M.Inst.C.E., of Westminster. In his report, this gentleman estimated that the total cost of carrying out the project would be £111,169; while the Borough Surveyor calculated that it would be £111,434, excluding the cost of reducing the present consumption of 45 gallons per head per day to 25 gallons, which was estimated by Mr. Deacon at £5000. Neither computation embraced a sum for the purchase of the rights of the Lord of the Manor, or others, if any. To carry out the scheme, it might be desirable, the Committee said, to obtain power to borrow £120,000; and the annual expenditure on the water-rate would be £7503 a year, provided the money was borrowed for 70 years. To meet this, it would be necessary to raise a rate of 8½ per cent.; the present rate being 6 per cent. This would mean practically a rate of 1s. 6d. in the pound; the existing rate being 1s. 1d. The borrowing powers of the borough under the Public Health Act, 1875, could not exceed twice the assessable value for the time being—viz., £260,000. This would be in addition to the borrowing powers under Local Acts and Municipal Corporations Acts. The present debt under the Public Health Act was £18,900; and under local and other Acts, £68,610. The Chairman of the Committee (Mr. J. Barker) moved that the report be received and considered, pointing out that the sole object of the Committee was to lay the whole of the facts before the Council, so that they might give them such instructions as were considered desirable. There could be no question as to the quantity or the quality of the water; Mr. Deacon having pronounced it to be "undoubtedly of excellent quality, both for potable and general use." The only question was as to the expense, and that he (Mr. Barker) did not look upon as an insurmountable objection, looking at the importance of a good and abundant supply of water for the town. The motion was seconded by Mr. Woodhouse; and then Mr. Holt moved, as an amendment, that the matter be deferred until the borough had a complete system of sewerage; for then, he argued, they would have a good supply of water at home. This was also seconded; but Alderman Southam subsequently moved that the matter be referred to a Committee of the whole Council for consideration. The medical men of the town, he remarked, had strongly condemned the river scheme; and he regarded Mr. Holt's amendment as one that would only result in delay. Alderman Southam's amendment was carried by 26 to 5 votes.

GAINSBOROUGH WATER SUPPLY.

In the JOURNAL last week, we briefly announced that the Gainsborough Local Board had decided to ask the Local Government Board to sanction a further loan of £2000 for the purpose of extending their water supply. As the Local Board had previously applied for £12,500, and their application had been considered at a local inquiry on the 27th ult., by Mr. F. H. Tulloch, Assoc.M.Inst.C.E., it may be of interest to reproduce, from a recent number of the *Engineer*, the following particulars in regard to the undertaking.

The Local Board of Gainsborough, acting as the Rural Sanitary Authority, have for several years past been engaged in discussing the best way of extending their water supply to meet the growing requirements of the town; and, owing to the different opinions held by several of the Board's advisers, the matter has attracted considerable interest outside the neighbourhood immediately concerned. The main

point at issue has been whether the required extension should be obtained from the River Trent, which has until recently formed the only source of supply, or whether a new one altogether should be sought from the lower beds of the new red sandstone formation which underlie the district. The Local Board have very carefully and impartially considered the question in all its bearings, and have consulted many eminent engineers and geologists, in order to ascertain definitely which scheme would secure them the best supply, both as regards quantity, quality, and cost; and they have now decided to adopt the deep-well scheme as recommended by Mr. C. E. de Rance, F.G.S., and subsequently by Mr. Jabez Church, M.Inst.C.E., of Westminster. For some time past a trial boring, which penetrated but a few feet into the water-bearing sandstone rock, has yielded a small quantity of excellent water, which, however, proved to be of inconvenient hardness. The Local Board have now carried this boring to a depth of 1350 feet from the surface, and by so doing have obtained a supply which is ample for their utmost requirements for many years to come, and which rises naturally to within a few feet of the surface. According to Dr. Frankland's report and analysis, the amount of hardness proves to be much less in the new supply than in the former one, and is "not excessive" and principally "temporary." He says: "This water, although turbid, is palatable, and contains only a very small proportion of organic matter; while it is also entirely free from any evidence of previous contact with sewage or other animal refuse. The hardness is considerable, but by no means excessive. Although a water containing less saline matter in solution would doubtless be preferable on general grounds, if it could be procured, there is no reason to believe that this water will not prove perfectly wholesome for dietetic purposes; while there is, of course, no comparison between the fitness of this water and the polluted river water which I analyzed for you some years ago. As the hardness of this water is principally of the kind known as 'temporary,' it is well adapted for artificially softening by treatment with lime (Clark's process), which would greatly enhance its value for washing and steam purposes." The new works for which it is proposed to borrow the amounts before mentioned include a well 250 feet deep, lined with cast-iron cylinders, and connected at the bottom to the existing borehole by means of a brick-lined adit or tunnel; a new engine-house, with sufficient area and the necessary foundations for duplicate pumping machinery; also a single set each of deep-well pumps and three-throw force-pumps, worked by a horizontal compound condensing engine. The plans for these works, as prepared by him, were submitted and explained to the Local Government Board Inspector at the inquiry, by Mr. Jabez Church, the Consulting Engineer to the Board in connection with the new works.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. J. M'Gilchrist, of Dumbarton, has closed the financial year of the Corporation gas-works with a deficit; but it is not an alarming one—amounting only to 3d. The total revenue was £7320. It has been resolved to retain the price of gas at 3s. 3d. per 1000 cubic feet to ordinary consumers, and 2s. 9d. for public lighting.

It was reported at a meeting of the Edinburgh Town Council this week, that a site for a central electric lighting station had been secured in Dewar Place, beside the Caledonian Railway, at the price of £7322. The ground is conveniently situated for the West-end of the city; but there will be a long carry of the current to the eastern end.

In Perth, in connection with the introduction of the Peebles oil-gas process, the Gas Commissioners have this week agreed to lay a pipe to convey the oil from the railway to the gas-works. This will effect a saving in the delivery of oil, compared with what it would cost were it sent to the works in barrels. The Commissioners will be able to contract for delivery at the railway siding, in tank-waggons, and run the contents of these into the well at the gas-works. The pipe-line will traverse several streets, and will cost about £50.

An exhibition of gas appliances has been held in Blairgowrie this week by Messrs. Fletcher, Russell, and Co., of Warrington, at which Miss Stoddart, of the Edinburgh School of Cookery and Domestic Economy, has been giving demonstrations in cookery. In Blairgowrie the charge for gas is at the high figure of 6s. 6d. per 1000 cubic feet; but, to encourage the use of gas cookers and stoves, the Directors of the Gas Company have resolved to reduce the price of gas used in them to 5s. per 1000 cubic feet. Taking advantage of the "boom" in gas affairs created by the exhibition, an enterprising merchant in the town issued circulars in which he recommended the use of paraffin oil for shop lighting, and stated the respective costs as being at the rate of 8d. per week for oil, and from 4s. to 5s. per week for gas. This is so evidently absurd, and so damaging, that the Manager of the Gas Company felt it to be necessary to issue counter-circulars, pointing out that the comparison was "a most unjust and absurd one," and asking the author of it to attend at the gas exhibition to hear it refuted. Such pluck on the part of the Gas Manager must be admired.

There was a recurrence last Sunday of the flooding at the Brechin Gas-Works. In August last, during a thunder shower, a tunnel was choked, and the water was forced into the works. This tunnel has not yet been repaired; and on Sunday, when rain fell in torrents, the water again rose in the gas-works, extinguishing the furnace fires in the retort-house. The workmen were able to divert the current, so as to prevent the other portions of the works being flooded. A meeting of the Town Council was held on Wednesday, at which the question of who is liable for the maintenance of the tunnel was discussed; and it was stated that the Gas Company had offered to contribute £250 towards the cost of repairing it, but that the offer had been declined. A Committee was appointed to confer on the subject with the Directors of the Gas Company and the Managers of a United Presbyterian Church, through whose property the tunnel runs.

The Newport, Fifeshire, Gaslight Company have paid a dividend at the rate of 5 per cent., and have reduced the price of gas by 5d. per 1000 cubic feet, making it 5s. A similar reduction of 5d. was made last year; and notwithstanding this, the Company had a greater gross revenue than they had in the previous twelve months.

The Turriff Gaslight Company, after reconstructing their retort-house and making other alterations upon their works, have been able to pay the customary dividend of 5 per cent. for the past year. The price of gas is 7s. 11d. per 1000 cubic feet, which is far too high.

It may be of some assistance to those of your readers who are in the thick of the coal dispute, to state the result of an arbitration which has just been concluded between the coalmasters and the miners in the Lothians. On Aug. 23 last, the coalmasters consented to an increase of 10 per cent. upon wages; but, on account of an advance having been immediately afterwards granted in the West of Scotland, the miners in the Lothians made a demand for another advance of 20 per cent. This the masters refused; but they offered to send the question to arbitration. This, very much to the credit of the miners, was accepted by them. The arbiter was Mr. J. D. Sym, Advocate. By the terms of the arbitration, contracts were excluded; and only current prices were taken into acconnt. These Mr. Sym had laid before him confidentially; and he has given as his decision that the prices do not warrant a further advance. The miners have lost; but everyone knows that they have lost on the merits of their case, and not because of any combination against them, or other circumstance. Is it a knowledge that their case will not bear investigation which has hitherto determined the miners in the Midlands to decline arbitration?

The Police Commissioners of Falkirk have resolved to charge way-leave upon the Gas Company in connection with the breaking up of the streets for the laying of pipes. There seems to be a little of a muddle in the matter. The proposed charge is to be made "before leave to open the streets is given," which is not the way in which it is done in other towns, and, I submit, is not the correct way. The Gas Company are under the obligation, when they open a street, to leave it in as good condition as they found it—which is rather difficult to do; but to charge them way-leave over and above the cost of restoration, is in the nature of an extortion. To call the charge way-leave is a misnomer; it is in reality compensation. If the charge were a fixed sum per annum for the use of the streets, it would be in accordance with a practice which is becoming common; and it would better suit the Gas Company than the fluctuating charge which will be made upon them. Should they lay no new pipes in any year, there will be no charge; while, on the other hand, in years in which they might renew or extend a leading main, the charge would be a high one. The Gas Company misunderstood the nature of the proposal; for, in a letter by their Clerk to the Police Commission, which was read at a meeting this week, it was maintained that the resolution to charge them was illegal and oppressive, and adverse to the interests of the whole community. The Clerk raised the subject of searching for escapes of gas; and he said that, if the Company were obliged to wait till a Committee of the Commissioners met and considered their application, great danger to the community might arise. He also hinted that the Company might withdraw the 12½ per cent. discount which they allow to the Commissioners, and that they might be obliged to raise the price of gas. I should say that 12½ per cent. discount upon the account for public lighting should be sufficient way-leave; and that, if the Police Commissioners are resolved to conduct their business upon hard-and-fast lines, the Gas Company are within their rights in conducting theirs in the same manner. A little concession on both sides, such as has existed hitherto, would be more sensible than mutual attempts to screw up revenue.

Mr. A. B. Brown, of the Rosebank Iron-Works, Edinburgh, a member of a firm who do a large business in the fitting up of electric lighting installations, recently published a letter in the *Scotsman*, in which he rated the Edinburgh and Leith Gas Commission for their refusal to supply gas to the Electric Lighting Committee, for use in gas-engines to drive dynamos, at 1s. per 1000 cubic feet lower than the price charged to ordinary consumers of gas. At the close of his letter, Mr. Brown expressed his disinterestedness in a remark to the effect that he is interested in the construction of steam-engines, but not of gas-engines. That is quite true; but he also stated, in the body of his letter, that he himself has a private installation in his house in the West-end of Edinburgh, which is supplied with energy by a gas-engine. In this connection, I think that the remarks I recently made upon this subject come in quite appropriately, because, if the Corporation were to get gas from the Gas Commissioners for electric lighting purposes at a reduced price, why should not owners of private installations enjoy the same benefit? It is open, therefore, to anyone to say that Mr. Brown had his own gas account in view when he wrote the letter. It is also pertinent to his position to say that probably he knows as well as anybody how utterly helpless an adventure it would be for him to enter upon the manufacture of gas-engines, but that, if the fitting up of private installations should become common, his firm would in all probability earn a considerable profit in the wiring and fitting of houses. The reply given by Mr. Councillor Mackenzie, also in the pages of the *Scotsman*, makes either Mr. Brown's letter or Professor Kennedy's report ridiculous. He said that Professor Kennedy "has adopted gas-engines for electric lighting in Belfast for sufficient reasons. He recommends steam in Edinburgh because, in the different circumstances, steam will be more profitable." Now Professor Kennedy worked out the cost of electricity, furnished by steam, at the very lowest at 2·5d. per unit; whereas Mr. Brown says, in his letter, that, in his private installation, he has for five years produced electricity by a gas-engine at 1¼d. per unit. If Mr. Brown is right, what is the necessity for the Corporation wishing to get gas? On the other hand, if Professor Kennedy is right as to the cost by steam power, it would be interesting to know how Mr. Brown makes his calculations. The discrepancy is only one of many which may be found in the statements of electricians; and it is for them to try and explain it away. The only pity is that the West-end citizens of Edinburgh, who are anxious to get the town to supply them with electric light at a cheap rate, will not see these discrepancies, and the poor people who will have to pay for the lighting of the houses of the wealthy are too ignorant, or too lethargic, to interest themselves in the matter. There is one portion of Mr. Brown's letter which is certainly incontrovertible—that in which he advocates the use of producer gas for the driving of dynamos. There, however, he blunders when he favours the Gas Commission supplying such gas. That would necessitate the laying of special mains, for which he

allows; but he thinks it would pay, because the mains need not be large, as the producer gas could be sent through them at a pressure of 20 inches water pressure. Well, that is quite correct; but could not the Electric Lighting Committee make their own producer gas?

The Edinburgh and District Water Trustees are terribly at sea in the matter of the proposed addition to the water supply. Perhaps the near approach of the municipal elections has a little to do with that; members being obliged to say something on the subject, to found an election cry upon, but at the same time being afraid to commit themselves till they see how the electors will decide. At all events, though the Trustees have been considering the subject for two years, they decided nothing on the main question at their meeting on Thursday of this week; and all that they did determine was that they are to spend another year in making inquiries as to the best source from which to take the new supply. They, however, made a discovery; and in that connection it is impossible not to sympathize with them. The discovery is that consulting engineers are "only good guessers." Three weeks ago I informed your readers that the advising Engineers had left it to the Trustees to decide between the Manor scheme and the Talla. It has since transpired that, on Sept. 14, they sent in the above report; but that on the forenoon of that day, before it could be delivered, they telegraphed to the Clerk to the Trust not to make use of it. When, therefore, the report arrived, at five o'clock in the afternoon, the Clerk put it under seal. A week afterwards another report was received, in which the Engineers recommended the adoption of the Talla scheme. At Thursday's meeting, a request that the first report should be returned, was intimated from the Engineers; and it was in connection with it that the Lord Provost announced the discovery that the Engineers were merely guessers. "Had," his Lordship said, "the Trustees been prepared to face the expenditure necessary to procure definite information, there would have been no need to consult Engineers. But they took the Engineers instead; and they had, to their sorrow, found that they had thrown away their money." It was curious to observe how all the Trustees, with one exception, professed not to know anything of the contents of the first report, and that notwithstanding that it was published in full in one of the local newspapers. I am afraid that, before the Clerk sealed it up, a copy of the report was made, which, there is no doubt, some of the Trustees saw. There was a long discussion as to whether the report should be returned—one side holding that it should not, as it was the property of the Trustees, and should be held in order that the Trustees might, if necessary, refer to it to correct erroneous statements; and the other side, that when a professional man changed his opinion his report ought not to be kept, nor made use of for any purpose. In the end, it was decided, by the casting vote of the Lord Provost, to return the report. The Trustees also resolved to print the reports of experts which were obtained in 1870-74, and circulate them; and, further, that the Works Committee should be empowered to have the streams in the proposed areas of supply gauged, the rainfall recorded, and borings taken to ascertain the nature of the foundations for embankments. The object of this resolution is to enable them to do away with engineers' fees.

A report by Messrs. Leslie and Reid to the Trustees, upon the working of the Deacon meter in Edinburgh, testifies to the good work done by the meter, which, it will be remembered, the Trustees were slow to adopt. There are now, it was stated, 58 districts under the command of a travelling meter, and 23 districts under the command of fixed Deacon meters; the area covered containing a population of nearly 190,000. Since Jan. 1 of this year, the total consumption of water in the area has been at the rate of 35·25 gallons per head per day; and in the corresponding period of last year, it was at the rate of 39·65 gallons. There has thus been a saving of 4 gallons per head per day by the use of the meter.

During the past year, the Perth Water Commissioners had a revenue of £5971, and an expenditure of £6060. For the current year, a revenue of £6027, and an expenditure of £5925 is expected. The assessments for the current year were fixed at 7d. per pound in regard to the domestic rate, 3½d. per pound upon shop property, and a public rate of 1d. per pound—all the same as last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 14.

Sulphate of Ammonia.—There is practically no change in the market. The quotations at country ports are £13 to £13 2s. 6d.; and the few parcels offering meet with a ready sale. The low quotations emanating from some of the principal dealers are creating some surprise, as no corroboration can be found for them in actual transactions. The manœuvre is apparently but an attempt to bring values down by force; and no doubt great disappointment exists on the part of buyers that prices have not fallen considerably more this month, and reached the hoped-for low level of £12. Stocks are extremely small just now, requirements large; and, with sufficient patience and caution, makers need not fear a much lower range than the present. Nitrate is unchanged.

LONDON, *Oct.* 14.

Tar Products.—There is more firmness in this market. Creosote, which has been so difficult to sell for the last twelve months, is now in considerable demand for fuel purposes; and it is being employed to such an extent, that stocks in makers' hands are entirely used up. Pitch is also strong for fuel purposes. Benzol retains the slight advance it has made; and there are more buyers for early delivery. The renewal of the Tar Products Sales Committee's arrangement has given strength to the anthracene market. The value of this product is certain to be maintained. The scarcity of fuel has, in several instances, brought tar into requisition as a substitute for coal; and it has had the effect of increasing the value of tar for early delivery. In one case as much as 17s. has been paid for it. The average price, however, may be taken at about 14s. to 15s. Other prices are as follows: Pitch, 26s. 6d. to 27s. 6d. Benzol, 50's, 1s. 7d.; 90's, 1s. 6d. Creosote, 2d. Creosote salts, 25s. Solvent naphtha, 1s. 3d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 7½d. Carbolic acid, 60's, 1s. 4d.; crystals, 5¾d. Cresol, 1s. 2½d. Anthracene, 30 per cent., "A" quality, 1s. 1d.; "B," 10d.

Sulphate of Ammonia.—The market is flat and weaker. Buyers are holding off in the hope of purchasing their requirements at lower prices. The little business that has been done has varied between £12 10s. and £13, less 3½ per cent. Gas liquor is quoted at 7s. 6d. to 8s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position generally throughout Lancashire shows no improvement, either as regards any appreciably lessened difficulty in obtaining supplies or the excessive prices which have to be paid; whilst as to any prospect of settlement, this has certainly not been brought any nearer by the offers of compromise contained in the Sheffield proposals and in the resolution passed at the coalowners' meeting on Tuesday. There seems no other outlook now than that the dispute will have to be fought out to the end; and on both sides the utmost firmness is still being maintained. So far, there has been no appreciable breaking away throughout Lancashire from the Coalowners' Federation; the full returns which the delegates at the Birmingham Conference on Thursday could present showing that not more than 4500 men had restarted at the old rate of wages, out of a total of about 70,000 men employed in and about the pits. No colliery concern of any importance has up to the present given way; and the output from the comparatively few collieries that are now working is too small to have any appreciable effect—most of it being disposed of by land sales at the pit mouth, at high prices. For supplies, both manufacturing and domestic consumers have still to rely upon coal coming in from outside districts, chiefly Scotland, Durham, Staffordshire, and South Wales; and deliveries of this continue very precarious and irregular, whilst prices have again further advanced during the week. For gas-works the position, as previously intimated, is week by week becoming more serious; and unless suitable supplies can be more readily obtainable before long, there will be a very considerable stoppage of gas-making operations. The Manchester Corporation have been able to procure supplies of cannel from Scotland, and also small quantities of gas coal from local pits that are working; but the outlook is very unsatisfactory. In any case, for gas coal supplies excessive prices have to be paid; good ordinary qualities, delivered at stations in the district, scarcely being obtainable under about 26s. to 28s. per ton. With regard to manufacturing classes of fuel, considerable quantities are coming in from Scotland; but ordinary descriptions of engine fuel are, for prompt delivery, readily fetching 20s. to 22s. per ton, with ordinary steam coal averaging 24s. to 25s. per ton at stations or wharves in the district. During the last few days, there has been some holding back from buying—at any rate, in anything like large quantities—in anticipation that the considerable number of pits which have restarted in one or two districts may before long hasten on a general collapse of the stoppage; but this has had no appreciable effect upon prices, except that perhaps it may have checked any further upward move, and sellers are still very firm in holding for their full rates.

Northern Coal Trade.—There is a decided change in the north-eastern coal trade; the restarting of collieries in the Midlands having greatly lessened the demand, and caused some reduction in prices. But the time is come when there is a natural increase in the consumption of coal, especially of gas and house coal; and thus the enlarged output is taken up without filling up the gap in the production. The demand is still strong for northern coal; and large quantities are being sent into Yorkshire, as well as by steamship to London. Prices are now very irregular—being ruled more by the time of delivery than by any fixed rates; and thus quotation of average rates is unusually difficult. Coalowners who have sold well forward ask high prices; whilst in other instances, rather lower rates are quoted. Best Northumbrian steam coal may be put at about 13s. per ton f.o.b.; and the collieries are well employed. When delivery of the coal is far forward, very much lower prices are taken; and even the figure quoted is a long way from being universally adhered to. Second-class steam coal is from 1s. to 1s. 6d. less than best steam; and small steam coal is still selling freely at from 5s. 6d. to 6s., with a good demand for prompt supplies. In regard to gas coal, the demand is enlarging generally. The northern coalowners have no stock; whilst there is still a considerable quantity being sent to Lancashire and Yorkshire, but in small lots. The bulk of the coal is again being sold on old contracts at 6s. per ton, or thereabouts; but some more recent sales are at better prices, and improve the average, though it is very difficult to quote exact rates. Manufacturing coal is firm; all stocks having been cleared away during the Midland miners' strike. Smithy coal is still in good demand, and at a relatively high price. In regard to coke, the shipments of late have been limited in comparison with those of a year ago; but the price for best Durham kinds is maintained at about 16s. per ton f.o.b. For gas coke, there has been rather a larger demand; and the stocks are being kept down, though the production has been increased of late, and must now continue to grow. There is no alteration this week in the prices generally.

Scotch Coal Trade.—In Scotland the demand for coal remains very large, and prices are still tending upwards. There is scarcely such a thing as a stock of coal at any colliery. Everything is being sent off as promptly as waggons can be got to load it in. Of these there is somewhat of a scarcity, as so many are being sent into England; but relief, to a large extent, is being found by the bringing of English waggons to Scotland. It was feared that the men would refuse to load English waggons; but, so far, they have not given trouble. The railway traffic is so large, chiefly on account of freights having advanced by about 50 per cent. There is, however, a very heavy shipping trade. The men are working steadily all over. During the week the award in the Lothians arbitration was given, and was against the men; the basis of the decision being current rates. Prices generally have advanced since the period of which account was taken in the arbitration, which was down to Aug. 30; and it is just probable that further

demands for an advance will now be made. The prices quoted for this week are: Main, 10s.; ell, 10s. to 10s. 3d.; splint, 10s.; and steam, 10s. 6d. per ton—f.o.b. Glasgow. The shipments during the week amounted to 238,175 tons—an increase over the preceding six days of 18,547 tons, and over the corresponding week of last year of 66,654 tons. For the year to date, the total shipments have been 5,769,592 tons—a decrease as compared with the same period of last year of 114,623 tons.

The Bacup Corporation and the Rossendale Water-Works.—The shareholders of the Rossendale Water Company have decided to accept the offer of the Bacup Corporation to purchase their undertaking. The Corporation are to pay a 5 per cent. dividend in perpetuity upon the paid-up capital of the Company; and the transfer is to take place next year if the Bill authorizing it receives parliamentary sanction.

Sales of Stock and Shares.—On Thursday last, Mr. T. S. Fallows offered for sale at Birmingham £20,000 of ordinary 7 per cent. stock in the *South Staffordshire Water Company;* being part of the capital authorized by their new Act. The stock was sold in £100 lots, which realized prices ranging from £42 to £44 premium.——On the same day, 35 shares in the *Consett Water Company* were put up for sale; and the highest price bid was £9 per share.

A Novelty in Connection with Street-Lamps.—We give the following on the authority of the *Financial News:* "The Portuguese are good hands at municipal management. A number of street-lamps were erected at Delogoa Bay recently, and a ladder was imported to be used in conjunction with them. The ladder was a foot or two short; so, instead of lengthening it, the town officials built a small platform around each lamp, and so got over the difficulty."

The Winding Up of the Rhyl District Water Company.—The shareholders of the Rhyl Water Company held a meeting last Saturday week, for the purpose of considering various matters having reference to the winding up of the concern. The Secretary (Mr. Bayliss) submitted the statement of accounts, which showed liabilities amounting to £151. Resolutions were then agreed to declaring dividends out of the accumulative property at the rates of 5 and 6 per cent. on the 5 and 6 per cent. shares and 2 per cent. on the ordinary shares for the first quarter of the year, authorizing the payment of £450 to Mr. Bayliss as an acknowledgment of his devotion to the interests of the Company, and assigning £200 to the Directors.

The Electric Lighting of Blackpool.—The new installation of electricity for the lighting of Blackpool was inaugurated last Friday; and the occasion was regarded as a holiday in the town. The chief part in the ceremony at the works was taken by the President of the Royal Society (Lord Kelvin). In commencing the proceedings, the Chairman of the Corporation Electric Lighting Committee (Mr. Pearson) stated that the installation would have an important bearing on the future progress of the town. They were enabled to supply electricity for 12,500 8-candle power incandescent lamps; and probably one-half of that number were already required. Lord Kelvin, in declaring the installation open, gave a short address, in which he advocated the municipal control of the electric light and tramways, and the national control of telephones and railways. In the evening a dinner was given by the Corporation at the Clifton Arms Hotel, at which Lord Kelvin was present.

Plymouth and Devonport Water Supply.—At a recent meeting of the Plymouth Borough Council, the Water Committee brought up during the proceedings a recommendation that the Council should enter into an agreement with the Devonport Water Company to supply the Company with water in bulk in time of drought, frost, or scarcity, at the rate of 2½d. per 1000 gallons; the Company in turn to supply the Corporation with water upon similar terms, and the following conditions to mutually apply: "The water to be so supplied only to be used within the limits of supply of the Company or the Corporation, as the case may be, and neither the Corporation nor the Company to be called upon to furnish any water unless they have sufficient to discharge their statutory obligations, and also their own wants and the wants of all their consumers for the time being, of which sufficiency the party called upon to supply shall be the sole judges; and that the agreement contain such other terms and conditions as the Water Committee may think necessary for the protection of the Corporation." The recommendation was agreed to.

Dispute between the Cardiff Corporation and the Gas Company.—There is a little difference at present between the Town Council and the Gas Company with regard to the repairing and cleaning of the public lamps. These are the property of the Corporation, who allege that the Company are compelled to keep them in order under an agreement. The matter came before the Council yesterday week, when the minutes of the Special Lighting Committee contained a resolution to the effect that, if a satisfactory reply was not received to a communication they had addressed to the Company, the Town Clerk should request the Directors to receive a deputation regarding the non-attention to their complaints as to defective burners, the supply of gas, &c. Referring to the subject, the Mayor (Mr. W. E. Vaughan) said that a satisfactory arrangement could not be arrived at with the Company, who treated the Corporation with contempt. The Committee had had a special meeting, at which he contended that the Corporation should try and get parliamentary powers to establish gas-works of their own; but he was overridden. He still thought that nothing would be done, unless they had spirit enough to take action in a Parliamentary Bill. Alderman Jacobs and other members condemned the action of the Company, and expressed the hope that, after the "insults" received from them, the question of taking the lighting into their own hands would be faced. In reply to Mr. Lewis, the Mayor stated that a limited area of the borough would be supplied with the electric light before March; but to light by this means the whole of the streets and lanes would be very expensive. If they had purchased the gas-works when they had the opportunity, the Corporation would now be saving £3000 a year. It was then agreed to wait for a report on the subject from the Committee before taking further action.

Improvements at the Sandwich Water-Works.—The Sandwich Corporation are about to extend the plant at their water-works by putting down duplicate engines, boilers, and pump, the accepted tender for the supply of which amounts to £1161.

Electric Lighting for Newport (Mon.).—The Newport Town Council last Tuesday determined to make application to the Local Government Board for their sanction to the borrowing of £28,000, to be repaid in 30 years, for the purpose of providing a supply of electricity in the borough. Mr. Robert Hammond has been consulted in the matter; and he has now been requested to prepare plans and specifications, in order that tenders may be obtained at an early date.

Gas and Water Affairs at Ripon.—The Ripon Town Council, at their meeting yesterday week, resolved to reduce the price of gas 2d.—making it 3s. 4d. per 1000 cubic feet. With reference to the water supply, a resolution was passed expressing the opinion of the members that it was desirable to procure an auxiliary supply from the Dallowgill Springs; it having been found necessary during the past few weeks to supplement the water in the Lumley Moor reservoir by pumping from the River Ure. The proposal, it was stated, had found favour with the Marquis of Ripon; and the Committee were instructed to take steps to acquire the springs.

The New Water Scheme for Redruth.—The Redruth Ratepayers' Association yesterday week adopted a petition, signed by 890 ratepayers, praying the Local Government Board to withhold their sanction to the borrowing by the Local Board of the £9000 required for carrying out their water-supply scheme, which was recently the subject of an inquiry by Colonel R. M. Ducat. The Association have also forwarded, for the consideration of the Board, an alternative scheme proposed by Mr. N. Trestrial, C.E. This, it is stated, differs from that of the Local Board in that it discards large and costly open reservoirs; and it provides for the newest type of pumping machinery, capable of raising 680,000 gallons in 24 hours, and separating by a dam underground the copper water from the pure. The alleged advantages of this scheme are said to be: First, an abundant supply of water, with a minimum of 20 gallons per head per day in summer; secondly, much purer water than is now obtainable; and thirdly, a saving in cost of £3000 or £4000.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 713.)

Issue.	Share	When ex-Dividend.	Dividend or Div. + Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	16½–17½*	..	6 0 0
100,000	10	"	7½	Do. 7 p. c.	10	11½–12½*	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102–104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½–11⅝	..	13 18 3
200,000	5	12 May	6½	Bombay, Limited	5	5⅝–6	..	5 8 4
40,000	5	"	6½	Do. New	4	3¾–4¼	..	5 13 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220–225	+2	5 2 2
180,000	"	"	8½	Do. New	100	165–170	+1	5 0 0
220,000	20	15 Sept	11½	Brighton & Hove Original	20	41–43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102–105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	42–44	..	5 4 7
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	15–16	..	5 1 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5⅛–6⅛	..	3 1 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97–100	..	6 0 0
150,000	20	13 July	8	Cagliari, Limited	20	26–28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	245–250*	+1½	5 0 0
165,000	"	"	9½	Do. New do.	100	187–192*	+2½	4 19 0
160,762	"	15 June	4½	Do. 4½ p. c. Deb. do.	100	125–130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	230–235	..	5 10 7
200,000	"	"	10	Do. 7 p. c. Pref.	100	191–196	..	5 2 0
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185–190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	21½–22½	+½	4 8 11
354,060	10	"	10	Do. Partly paid	7½	15–16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	225–230	..	5 4 4
100,000	"	"	4	Do. B, 4 p. c. max.	100	95–100	..	4 0 0
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	263–268	+1	3 14 7
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	120–125	..	4 0 0
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	175–180	..	4 3 4
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	173–178	+1	3 18 7
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	262–267	+1	3 14 10
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	157–162	+2	3 14 1
1,061,150	"	15 June	4	Do. 4 p. c. Deb. Stk.	100	127–130	+1	3 1 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	132–137	+4½	3 5 8
908,000	"	"	6	Do. 6 p. c. do	100	175–180	+3	3 6 8
3,800,000	Stck.	12 May	12	Imperial Continental	100	228–233	–2	5 3 0
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5¼–5¾	..	5 4 4
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	104–106	+1	4 14 2
541,920	20	15 June	5	Monte Video, Limited	20	12⅜–13⅛	..	7 8 2
150,000	5	31 May	10	Oriental, Limited	5	7⅞–8	..	6 5 0
60,000	5	29 Sept.	7	Ottoman, Limited	5	4–4½	..	7 15 6
166,870	10	—	2	Pará Limited	10	1⅞–2	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100–105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98–102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8½–9⅜*	+1	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	304–309	..	5 0 4
1,350,000	"	"	12	Do. B do.	100	248–253	..	4 14 10
260,000	"	"	13	Do. C do.	100	259–264	..	4 18 5
750,000	"	13 July	5	Do. 5 p. c. Deb. Stk.	100	148–152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210–215	..	5 7 3
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	268–273	+1	3 13 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	215–220*	+2	3 12 9
544,440	"	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140–143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	113–117	+2	3 12 8
708,000	Stck.	16 Aug.	11	Kent	100	285–290	..	3 15 10
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	244–249	..	3 16 3
406,200	100	"	7½	Do. 7½ p. c. max.	100	199–204	..	3 13 6
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128–131	..	3 1 0
500,000	100	16 Aug.	12½	New Rive, New Shares	100	335–340	+2	3 11 4
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132–135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10p. c. max.	100	155–160	+2	3 15 0
126,500	100	"	6	Do. D 7½ p. c. do.	100	145–150	+3	4 0 0
1,155,066	Stck.	15 June	10	West Middlesex	100	262–267	..	3 14 10

*Ex Div

The Electric Lighting Scheme for Derry.—In our "Electric Lighting Memoranda" last week, reference was made to the electric lighting scheme of the Derry Corporation. The system which has been adopted by Mr. Blake, the Consulting Engineer, is the high-pressure continuous current, worked direct from the central station. There will be two circuits in each street; and every alternate lamp will be placed on one of these circuits, so that one-half of them can be lighted or extinguished simultaneously. Six dynamos are provided—each being capable, it is said, of running 60 arc lamps of 2000-candle power; but, as two of these will be held in reserve, there will be in constant use four, which will be equal to running 240 lamps.

The Manchester Corporation and Meter-Rents.—Referring to the article on this subject which appeared in the JOURNAL last week, our Manchester Correspondent writes: "The Manchester Gas Committee have accepted without much pressure an instruction to consider whether the time has not arrived for the abolition of meter-rents. It is perhaps a mere coincidence that the question has come prominently to the front on the eve of the municipal elections; and it may at least be hoped that the good intentions by which certain members of the Corporation are animated will not fade into nothingness so soon as the ballot-box has lost its terrors. At all events, the Committee ought to have little hesitation in returning an affirmative answer to the question which has been put to them. Less than eighteen months ago, they were almost unanimously in favour of a still greater concession to the consumers. They would then have reduced the price of gas by 3d. per 1000 cubic feet, if a majority of the City Council had not been fearful of the effect of an increase of the direct burdens of the ratepayers. It is hardly necessary to say that the Committee can well afford to either abolish meter-rents or to lower the price of gas. In fact, they could do both, and still have a balance on the right side of the account if the gas profits were not wanted to make up the deficiency of costly schemes of an unproductive character. Meter-rents brought in last year £12,527 out of a total revenue of more than half a million. When a reduction of 3d. per 1000 cubic feet was proposed to be made in the price of gas, it was calculated by one of the opponents of this policy that the loss of revenue would be £36,000; so that, roughly speaking, the income derived from meter-rents is equal to about 1d. per 1000 cubic feet. The net profit of the Gas Department last year was, however, £64,792, of which £46,046 went to the City Fund, and £18,746 was placed to what is called the 'contingent fund account' for extraordinary renewals of plant. There is therefore no question of the ability of the department to stand the loss of revenue. The sole point is whether the Gas Committee and a majority of the Corporation will rise superior to the extravagant demands of the spending departments. Mr. Brooks, the Chairman of the Committee, hinted darkly, when the matter was under consideration, that the ratepayers' burdens were very heavy, and that there was an indisposition to increase them. There would probably be a strong inducement to decrease them were the burdens all placed on the right shoulders. Manchester gas consumers have patiently borne more than their fair proportion."

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

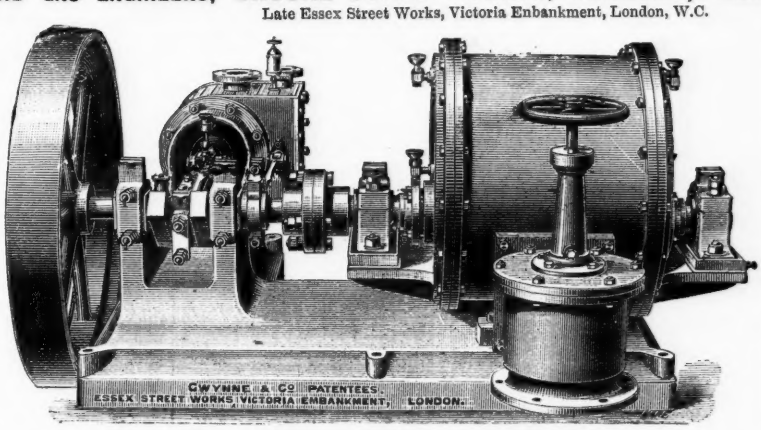
Late Essex Street Works, Victoria Enbankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
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CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
***See Advertisement p. IV., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
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LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

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GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
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Telegrams: "BOGORE, LONDON."

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FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

G. L. LAMBERT, 26, Alberta Terrace, Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

GAS Engineering Draughtsman desires employment. Served four years with leading Gas Plant Makers, and two in Provincial Works. Good testimonials.
Apply, by letter, to No. 2292, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young married Man, a Situation as WORKING MANAGER of Gas-Works. Has held his present management four years (steam engine and exhauster employed).
Apply, by letter, to No. 2290, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser (aged 29, and total abstainer), a Situation on a Gas-Works as ASSISTANT to Engineer or Manager, or Book-keeper. Six years in present Situation. Speaks Portuguese thoroughly. No objection to go abroad. Will be disengaged by end of January, 1894. Good references.
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LEADING Gas-Fitter wanted. Wages 35s. a week.
Apply, giving full particulars, to the ENGINEER, Wallasey Gas-Works, Great Float, BIRKENHEAD.

CLEETHORPES GAS COMPANY.

WANTED, at once, a capable trust- worthy Man as WORKING FOREMAN. House, Coals, and Gas free.
Apply to E. J. BROCKWAY, Engineer and Manager.

WANTED, a steady young Man as STOKER. One from a small Works preferred, and used to Shovel Charging.
Apply, giving age, references, &c., to the MANAGER, Gas-Works, Sandown, ISLE OF WIGHT.

THE Madeley Coal and Iron Company, Limited, Madeley, near Newcastle, North Staffordshire, have some GAS COALS to sell. Prompt delivery.
Telegraphic Address: "SETTLE, MADELEY, STAFFS."

FOR SALE (immediate delivery)—A per- fectly new GASHOLDER, 30ft. by 12ft., with wrought Tank complete. Design and Specification on application. Price cheap, including fixing where required.
Address W. C. HOLMES AND CO., HUDDERSFIELD.

PURIFIERS.

FOR SALE—Three 6-feet square PURIFIERS, complete with lifting arrangement, 6-inch Valves, and Connections. Replaced by others of larger capacity.
Apply to F. TURNER, Manager, Gas-Works, CHARD.

TO LOCAL BOARDS AND OTHERS.

FOR SALE—A Sugg's Patent Photo- meter. Prize Medal 1862. No reasonable offer refused.
Apply to the ASSISTANT CLERK, Lambeth Vestry Hall, KENNINGTON GREEN, S.E.

FOR SALE, the following second-hand GAS PLANT:—
GASHOLDER, 35 ft. by 14 ft.
GASHOLDER and Cast-Iron TANK, 30 ft. by 17 ft.
Four PURIFIERS, 12 ft. square by 4 ft. 6 in. deep.
Cast-Iron SCRUBBER, 36 ft. high by 10 ft. diameter.
CONDENSERS to pass 500,000 cubic feet per diem.
EXHAUSTER to pass 20,000 cubic feet per hour.
Also various other sizes of above or any Gas Plant. Inquiries invited.
Apply to SAML. WHILE, 60, QUEEN VICTORIA ST., E.C.

SPECIAL BARGAIN.

FOR SALE—A perfectly new 30,000 feet per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
The whole of the above plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Isle of Thanet Gas Company are prepared to receive TENDERS for 50,000 or 70,000 gallons of TAR, or less quantity, at their Works at Margate.
The said Tar will be pumped into Tanks or Barrels on the Company's Premises; but all other costs and charges to be paid by the Contractor.
The Directors do not bind themselves to accept the highest or any tender.
Tenders, endorsed "Tar," to be sent in on or before Thursday, Oct. 26, addressed to the Chairman of the Company.
Further Information can be had on application to the Manager.

By order,
THOS. C. FULLER,
Secretary.

Gas Offices, The Dane, Margate,
Oct. 13, 1893.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

OAKHAM GAS COMPANY.

THE Directors of the Oakham Gas Com- pany, Limited, invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced during the Year from Nov. 1, 1893, to Nov. 1, 1894, delivered into Purchaser's Tanks at Oakham Station. Coal carbonized, about 800 tons.
Tenders to be sent in not later than Oct. 23, 1893.
Tenders to be addressed to the undersigned, from whom all Particulars may be obtained.

JAS. MASON,
Manager.

Oakham, Oct. 13, 1893.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for repairs at their Neepsend and Effingham Street Stations during the next Twelve Months.
Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered, by post, addressed to the undersigned, not later than Saturday, Nov. 4 next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Oct. 13, 1893.

WALLASEY LOCAL BOARD.

NEW GAS-WORKS.

TO ENGINEERS AND MAKERS OF GAS PLANT.

THE Wallasey Local Board invite TENDERS for the whole or any portion of the under-mentioned WORKS:—
Contract 5—ANNULAR CONDENSERS.
Contract 6—ROTARY EXHAUSTERS and ENGINES.
Contract 7—TOWER SCRUBBERS.
Contract 8—PURIFIERS, FLOORING, &c.
Contract 9—MORTAR MILL and ENGINE.
Contract 10—LOCOMOTIVE TANK ENGINE.
Copies of the Specifications may be obtained on application to the Engineer, Mr. H. Ashton Hill, Assoc.M.Inst.C.E., at the Gas and Water Works, Great Float, near Birkenhead.
A charge of 10s. 6d. will be made for copy of each specification, to be returned on receipt of a *bond-fide* tender.
Sealed tenders, on the form provided for the purpose, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Condensers" (or any other contract, as the case may be), to be delivered at my Office, Church Street, Egremont, Cheshire, not later than Five o'clock p.m., on Monday, Nov. 27.
Each Contractor will be required to enter into a bond with approved sureties, for the due performance of the contract, which contract and bond will be prepared at the expense of the Contractor.
The Board do not bind themselves to accept the lowest or any tender.

By order,
W. DANGER,
Clerk to the Board.

Public Offices, Egremont, Cheshire,
Oct. 13, 1893.

CEARA GAS COMPANY, LIMITED.

NOTICE is hereby given, that the ORDINARY ANNUAL GENERAL MEETING of the Shareholders will be held at the Offices of the Company, 6, Queen Street Place, Cannon Street, in the City of London, on Friday, the 27th day of October, at One o'clock in the Afternoon, to receive the Report of the Directors, to declare a Dividend, and for general purposes.

By order of the Board,
THOMAS GUYATT,
Secretary.

Sept. 29, 1893.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
INCORPORATED BY ACT OF PARLIAMENT.

NOTICE is hereby given, that the Half- YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association will be held at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 7th day of November next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 30th of June last, and the usual Ordinary Business of such Meeting transacted.
Notice is hereby also given, that the Transfer Books will be closed from the 24th inst. to the 7th of November, both days inclusive.

By order of the Board,
R. S. GARDINER,
Secretary.

21, Austin Friars, London, E.C.,
Oct. 16, 1893.

NOW READY.

GAS AND WATER CO.'S DIRECTORY, 1893.
Seventeenth Annual Issue, 5s.
GAS-WORKS STATISTICS, 1893.
Fifteenth Annual Issue, 3s. 6d.
WATER-WORKS STATISTICS, 1893.
Thirteenth Annual Issue, 2s. 6d.
Handsomely Bound in One Vol., Price 10s.

LONDON: HAZELL, WATSON, & VINEY, Ltd.,
1, CREED LANE, E.C.

Now Ready, Price 6s., Cloth Bound.

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas Making; Destructive Distillation; Condensation; and Purification.

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WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Now Ready, Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS OF THE Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by

ALFRED LASS, F.C.A.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

Just published, Price 7s. 6d.

THE REGISTRATION OF TRANSFERS
Of Transferable Stocks, Shares, and Securities;
With a chapter on the Forged Transfers Acts, and an Appendix of Forms for Directors, Secretaries, Registrars, and Officers of Public Companies and other bodies.

BY GEORGE ENNIS AND GEORGE FRANCIS MACDANIEL ENNIS,
Both of the Middle Temple, Esquires, Barristers-at-Law.
London: EFFINGHAM WILSON & CO., Royal Exchange.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
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Prices and Analysis of all the Scotch Cannels on application.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

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LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

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HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-ON-TYNE.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft
Illuminating Power	16·3 candles
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works

(also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

T.B.KITTEL. SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

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FIRE-CLAY & BRICK WORKS,

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OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13¼ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

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WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

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IN USE AND ON ORDER FOR OVER 100 WORKS,
AND EQUAL TO
5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—

The Four-Blade Exhauster **PASSES 50 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
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One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.
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Washer-Scrubbers, with **WOOD CLUSTERS,** and Tar Extractor combined.

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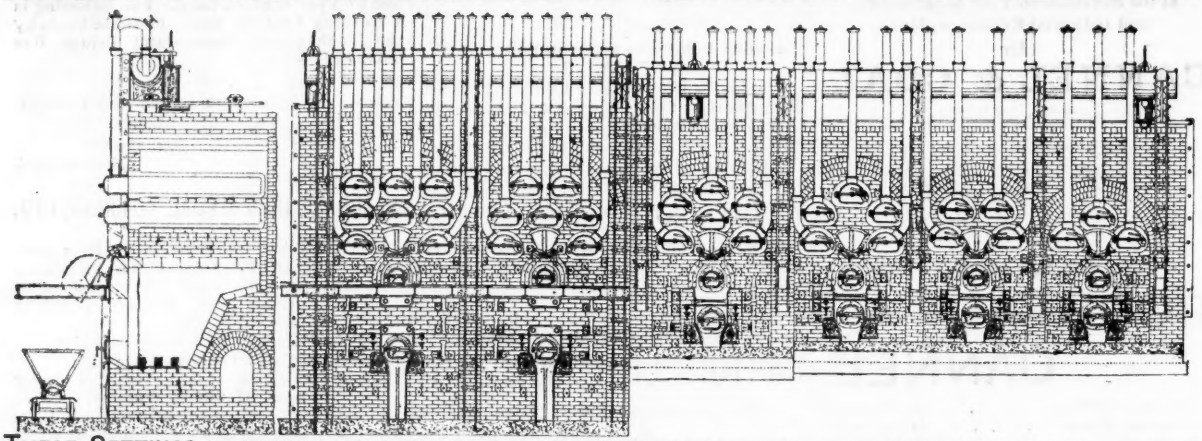
HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

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HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

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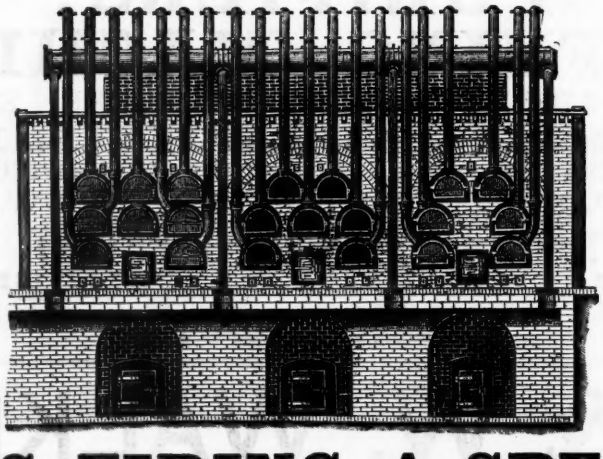

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Two-Lift	60ft. 0in.	diam. by	20ft. 0in. deep.
„	40ft. 0in.	„	18ft. 0in. „
„	45ft. 0in.	„	10ft. 0in. „
Single-Lift, prepared for telescoping	50ft. 0in.	„	18ft. 0in. „
„ „ „	58ft. 0in.	„	20ft. 0in. „
„ „ „	80ft. 0in.	„	20ft. 0in. „
Single-Lift	16ft. 0in.	„	10ft. 0in. „
„	60ft. 0in.	„	18ft. 0in. „
Two-Lift	35ft. 0in.	„	12ft. 0in. „
Single-Lift	16ft. 0in.	„	15ft. 0in. „
Two-Lift	73ft. 0in.	„	24ft. 0in. „
„	79ft. 0in.	„	23ft. 4in. „
„	20ft. 0in.	„	10ft. 0in. „
Single-Lift	50ft. 0in.	„	14ft. 0in. „
Three-Lift	90ft. 0in.	„	20ft. 0in. „
Addition of third Lifts (two)	102ft. 0in.	„	28ft. 0in. „
Three-Lift	100ft. 0in.	„	24ft. 0in. „
Two-Lift	100ft. 0in.	„	30ft. 0in. „
„	50ft. 0in.	„	20ft. 0in. „
Single-Lift, prepared for telescoping	60ft. 0in.	„	20ft. 0in. „
„	60ft. 0in.	„	20ft. 0in. „
Addition of fourth Lift	124ft. 0in.	„	22ft. 0in. „
Single-Lift	80ft. 0in.	„	20ft. 0in. „
„ prepared for telescoping	74ft. 0in.	„	20ft. 0in. „
Two-Lift	39ft. 3in.	„	15ft. 6in. „
Three-Lift	115ft. 6in.	„	24ft. 0in. „
Single-Lift	72ft. 0in.	„	18ft. 0in. „
„	35ft. 0in.	„	12ft. 0in. „
Three-Lift	100ft. 0in.	„	24ft. 0in. „
„	132ft. 9in.	„	31ft. 0in. „

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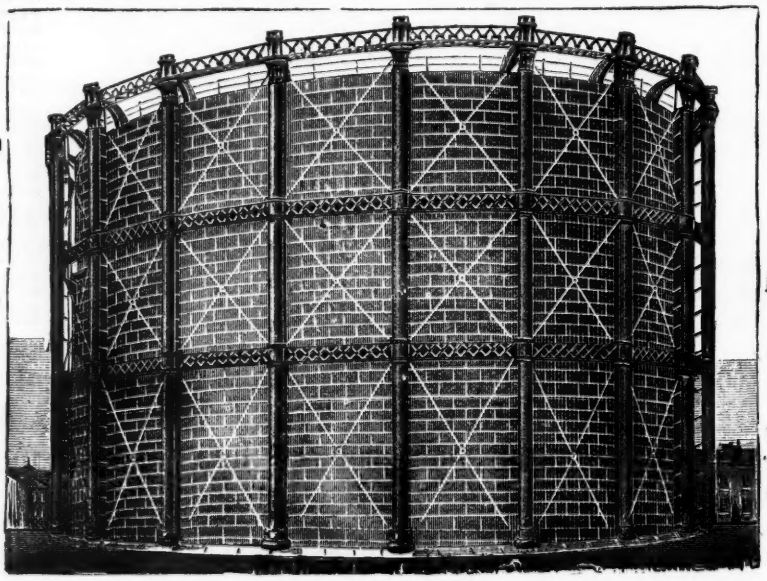

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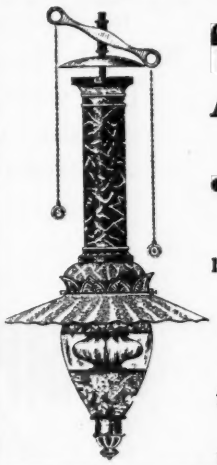

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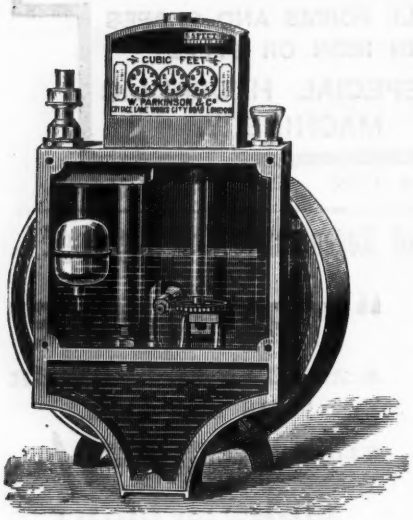

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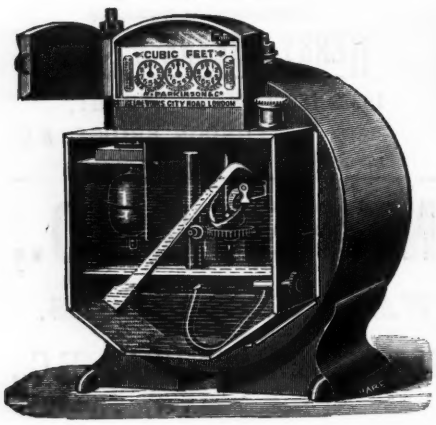

COMPENSATING METERS

IN TINNED OR CAST-IRON CASES.

The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.

DRY METERS.

These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected and the brasswork and smaller fittings are of superior workmanship.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE,
MANCHESTER.
Telegraphic Address: "PRECISION."

[See also Advt. p. 710.

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